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International Journal of Orthodontia and Dentistry for Children

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International Journal of Orthodontia and Dentistry for Children

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International Journal of
Orthodontia and Dentistry
for Children

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VOL. 20 ST. LOUIS, DECEMBER, 1934 NO. 12

ORIGINAL ARTICLES

DENTAL ABNORMALITIES FOR THE ORTHODONTIST'S CONSIDERATION

FRED RALPH BLUMENTHAL, D.M.D., BOSTON, MASS.

THE purpose of this paper is to show definite evidence of the necessity for a more complete and more careful study of our younger patients. Definite evidence will be offered to show why a thorough history of the child should be obtained and why a complete radiographic examination should be made of all children who come under your care for observation or for active treatment—children at the ages of three and four and up to fifteen and sixteen years, regardless of whether you find clinical evidence of abnormalities. The scope of this paper is so broad that only some of the most important and most common conditions will be considered, and descriptions will necessarily be brief.

First, it is absolutely imperative that the orthodontist be thoroughly familiar with the normal anatomy of the part at the age at which the diagnosis is being made. In using the term "normal" it should be understood as a condition which occurs within the allowed range of variability. Frequently the teeth, upon first erupting, may appear to be outside or inside the line of their theoretically normal position or may even appear quite rotated. These conditions are oftentimes considered as abnormal by the inexperienced operator, and orthodontic appliances are frequently inserted; whereas, in truth, these positions are not abnormal and the action of the tongue, lips, or muscles will soon place them in their permanent and normal positions if left alone.

Frequently a diagnosis of impacted canine teeth or insufficient space for the normal eruption of teeth is made at the age of seven, eight, or nine years,

Presented before the New York Society of Orthodontists, November 20, 1933.

and orthodontic appliances are oftentimes advised to stimulate the growth of the maxillae. Again certain third molars are diagnosed as impacted or eventually to become impacted, because of their inclination and position in the maxillae; and immediate extraction of these teeth is then advised, these diagnoses also being made at the ages of eight, ten, and twelve years. From a study of periodic radiographs, following the development of the teeth and jaws at various ages, I can assure you that many of these are not really impactions but rather Nature's wonderful and beneficent arrangement for stowing away, neatly and compactly, her future appendages while awaiting the normal growth and development of the maxillae.

No part of the human anatomy is free from abnormality. There are children with six fingers and some with six toes; others have no fingers, and still others, no toes. Some children have but one eye and some but one ear. Why then should we not expect to find abnormalities of the dental apparatus which begins to develop as early as the fifth or sixth week of fetal life, and which is, at best, so complicated?

And now, with this introduction, I shall take the liberty of briefly reviewing the normal anatomy of the parts in which we are interested and then I shall show variations and abnormalities.

Fig. 1 represents the skull of a child at birth. You will note there is no alveolar process and the distance between the lower border of the maxilla and the orbit is very short. Stored away in this area between the lower border of the maxilla and the orbit, and in the entire body and ramus of the mandible, extending up almost to the sigmoid notch, there is at this early age the full complement of the deciduous teeth, well calcified and some of the permanent teeth semicalcified.

Fig. 2 is a radiograph of a child's head at birth. You will note the calcification of the deciduous teeth and the well-defined follicle of the first permanent molar.

Fig. 3 is a cross-section of the skull at birth, showing the large amount of calcification of the deciduous teeth. Note especially the palatal bone. You have often heard the familiar statement that the "roof of the mouth is also the floor of the nose." Note the relation of the septum to the palatal bone and that of the turbinate bones to the septum, and now you can well visualize and be your own judge as to whether or not you personally believe that a deformity of the palatal bone, such as is evidenced by a narrow and high vault, could affect the relationship of the internal structures of the nasal cavity and the structures of the face. This is a much disputed question and is a splendid problem for your research.

Fig. 4 is of a child approximately one year of age; the outer plate of bone has been removed. You can see the well-calcified crowns of the deciduous teeth and the first permanent molar lying partly in the ascending ramus of the mandible. The parallel relation of the occlusal surface of this tooth and the free border of the mandible is a point well worth noting. I shall show this parallel relationship later in other posterior teeth.

Fig. 5 shows a normal child approximately six years of age. Note the erupted mandibular first permanent molar and the well-calcified crown of the second permanent molar lying partly in the ascending ramus. Note again the parallel relation of the occlusal surface of this tooth to the free border

Fig. 1.

Fig. 4.

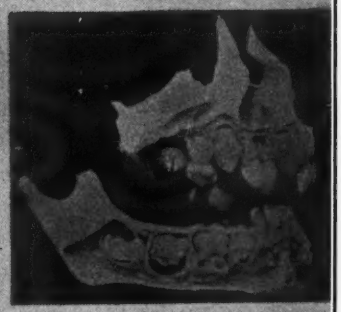

Fig. 2.

Fig. 5.

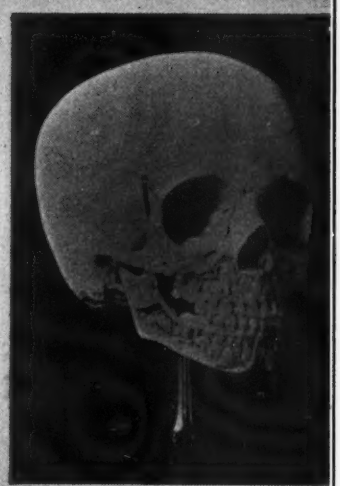

Fig. 3.

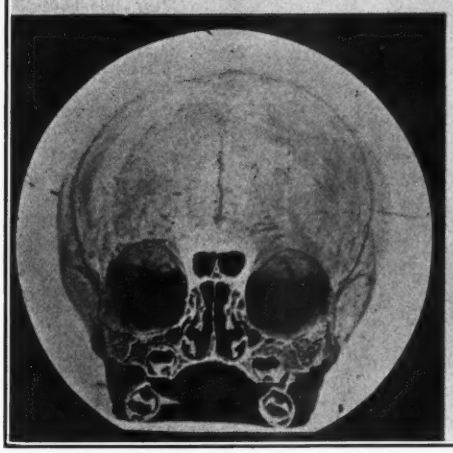

Fig. 1.—Skull at birth.
Fig. 2.—Radiograph of head at birth.
Fig. 3.—Cross-section of skull at birth.
Fig. 4.—Maxillae at about one year.
Fig. 5.—Skull at six years.

of the mandible; for this factor, I believe, may be most essential in determining whether or not the tooth will erupt normally or become impacted. The roots of this tooth develop and as the mandible develops, ample space is

afforded for this tooth to become a member of the oral cavity. Note particularly the position of the maxillary permanent canine tooth, its close proximity to the nasal cavity and also to the orbital wall. You can readily appreciate from this picture how an early traumatic injury to the deciduous canine could affect the position of the calcifying crown of the permanent canine, deflecting it so that it might become impacted or attempt to erupt in some unexpected position. I have seen radiographs showing the permanent canine attempting to erupt through the orbital wall. You can also visualize from this picture

Fig. 6. Fig. 7.

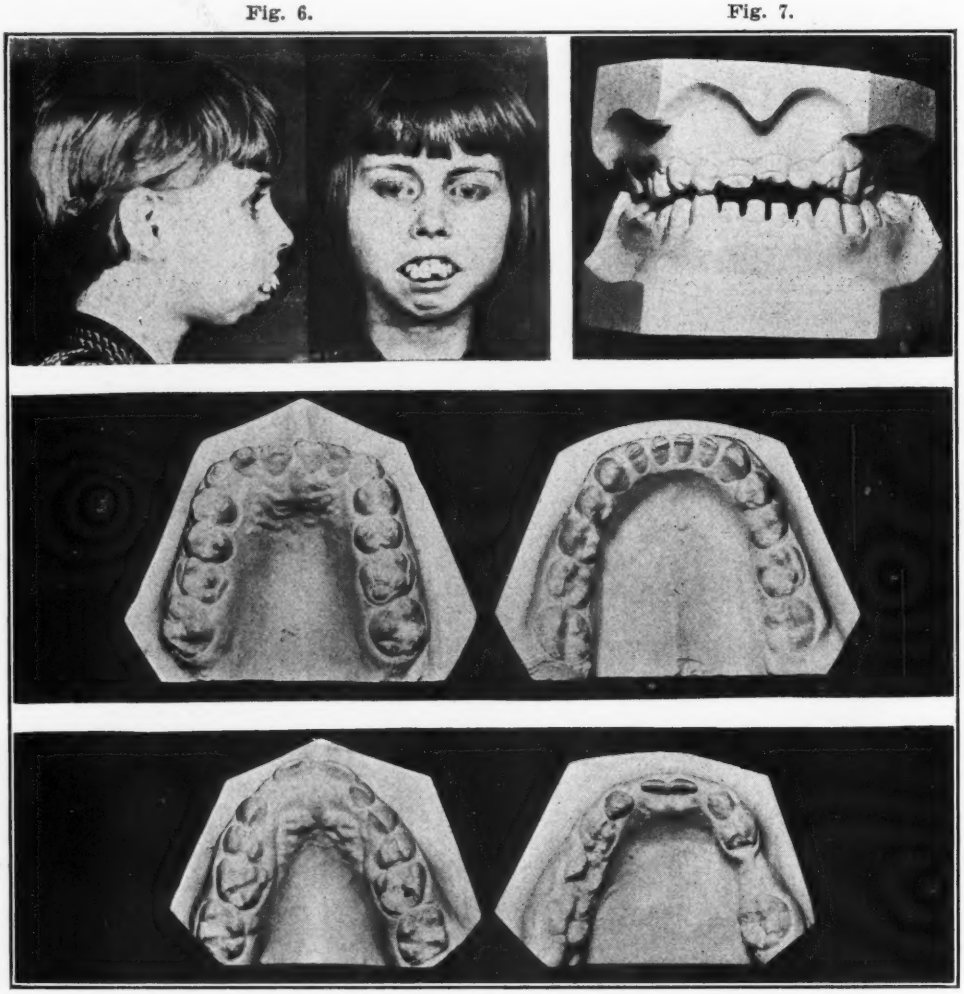

Fig. 8.

Fig. 9.

Fig. 6.—Rickets. (Courtesy of Dr. F. A. Delabarre.)
Figs. 7 and 8.—Congenital syphilis.
Fig. 9.—Arch deformity due to carious teeth.

how an injury to the maxillary deciduous incisors, frequently caused by a young child falling against a radiator or hitting himself on a milk bottle, might cause the roots to affect the enamel of the calcifying permanent incisors or might deflect them; and their eruption in the nasal cavity, with no history other than early trauma, may thus be easily explained.

There have been passed down from generations of orthodontists, certain stereotyped "causes of malocclusion." Some of the these have been clearly

proved and are quite acceptable; yet others, which I regret to state are still taught by some teachers of orthodontia, have been clearly disproved and should be discarded as untruths, proved by the advance of scientific research I am quite convinced that, because of the inadequate knowledge as to the nature, the cause, the recognition and the possible prevention of dental abnormalities, many more cases are being treated by the orthodontist than are actually necessary. The necessity for extensive, yet practical research in the etiology of dental abnormalities is quite in evidence. In the zeal and quest to learn more about the hidden and yet unsolved etiologic factors controlling dental abnormalities, many overlook those simple and so prevalent causes

Fig. 10.

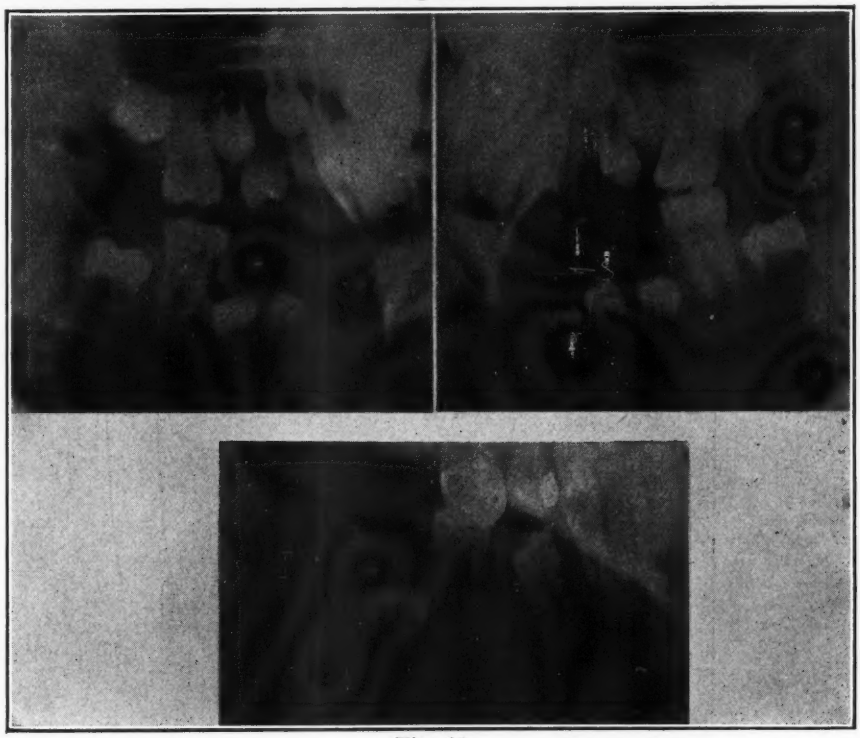

Fig. 11.

Fig. 10.—Overretained roots.
Fig. 11.—Pathologic condition of deciduous root.

which are truly of utmost importance. The extent of their malinfluence is hardly appreciated.

Now as to the importance of a thorough history of the child. Fig. 6 shows a rachitic child. Rickets, which is a disease of malnutrition affecting the bony structures, is quite prevalent in early childhood. Although this disease may not, in itself, affect the tooth structure, it may so affect the surrounding structures supporting them that they do not withstand the normal stress of mastication, and thus the teeth may be forced into abnormal positions. I believe that the success of orthodontic treatment for children who have suffered from extreme cases of rickets is sometimes questionable.

Congenital syphilis, which is much more prevalent among our patients than is sometimes realized, often causes certain characteristic dental abnormalities. (Fig. 7.) First of all we may have the Hutchinsonian central incisors. As I believe you are all quite familiar with the histologic formation of these teeth, I shall not discuss that phase at this time. There are, however, other characteristic deformities. There frequently is an inhibition in growth of the premaxillary bone, giving the appearance of infraocclusion.

Fig. 12.

Fig. 13.

Fig. 14.

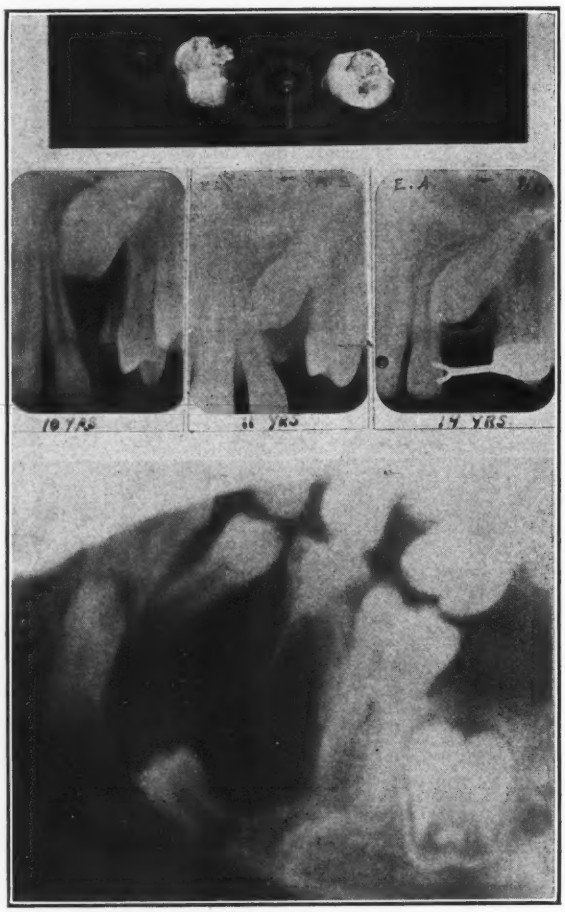

Fig. 12.—Caries of unerupted tooth.
Fig. 13.—Unerupted permanent tooth due to cyst.
Fig. 14.—Deflection of permanent tooth due to cyst.

There is also, in some cases, a characteristic square arch as shown in Fig. 8. The "mulberry molar" is of significance and the characteristic mandibular incisor which is extremely narrow in the mesiodistal dimension should be noted.

Your history of the patient should also include the possibility of defects due to the ductless glands which, without question, have a direct bearing on certain dental abnormalities.

The problem of carious teeth and overretained roots is illustrated in Fig. 9. A child having painful, carious deciduous teeth will endeavor to chew on

those teeth less carious or free of caries. Function may thus be interfered with, and as function is an important factor in normal growth and development, a malshaped arch may result.

Deciduous tooth roots allowed to remain may deflect the erupting crowns of the permanent teeth and the tooth may erupt in lingual, labial, or torsoocclusion (Fig. 10). The pathologic condition from abscessed deciduous roots may cause extensive destruction of the enamel of the permanent crown before it has erupted (Fig. 11), and Fig. 12 bears definite evidence of the positiveness of this statement. Cysts may develop from the pathologic

Fig. 15. Fig. 16.

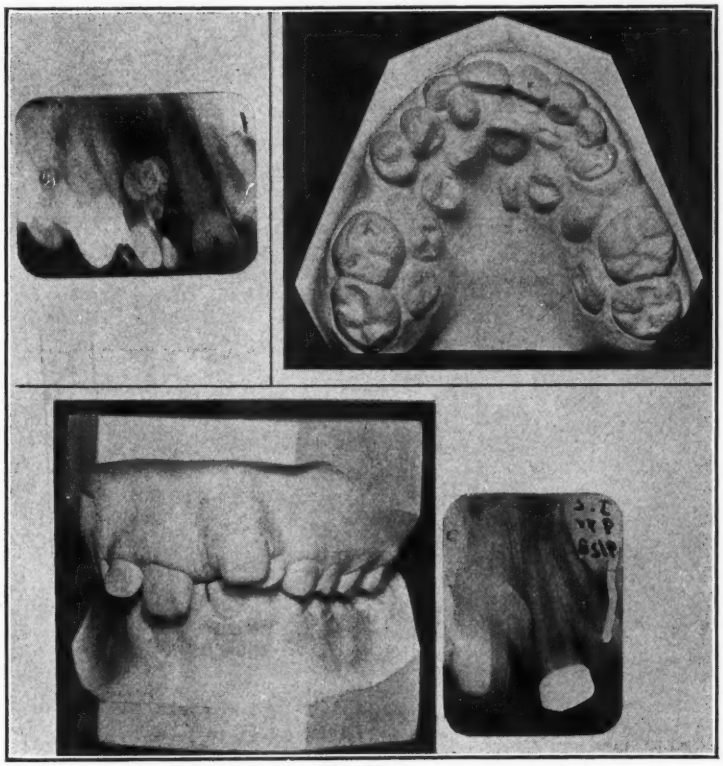

Fig. 17.

Fig. 15.—Dental adamantoma.
Fig. 16.—Supernumerary teeth. (Courtesy of Dr. H. E. Cohen.)
Fig. 17.—Malocclusion due to a supernumerary tooth.

condition of the deciduous tooth or roots, and the developing permanent tooth may be deflected by the fluid pressure into such extreme positions that its normal eruption is impossible. In Fig. 13 you will see what appears to be a simple alveolar abscess on the deciduous canine root. The child at this time was but ten years of age. The patient had the deciduous root removed and I waited patiently for the eruption of the permanent canine. When the child was eleven years old, the maxillary right permanent lateral incisor began to migrate distally, closing the space between it and the maxillary first premolar; and, as the radiograph shows, it was probably due to the abnormal pressure of the unerupted maxillary right permanent canine. At this time,

age eleven, a simple appliance was inserted to correct the distal drifting of the maxillary right lateral incisor, and a space retainer was inserted as is shown in the third radiograph. This retainer was in position at the age of fourteen years, yet there was no appearance of the maxillary right canine, although the maxillary left canine had fully erupted at the age of twelve years. Closer examination at this time revealed the fact that there was a cystic wall in the maxillary right canine region which I believe was a pathologic result of the original abscessed deciduous root. From a study of many

Fig. 18. Fig. 19.

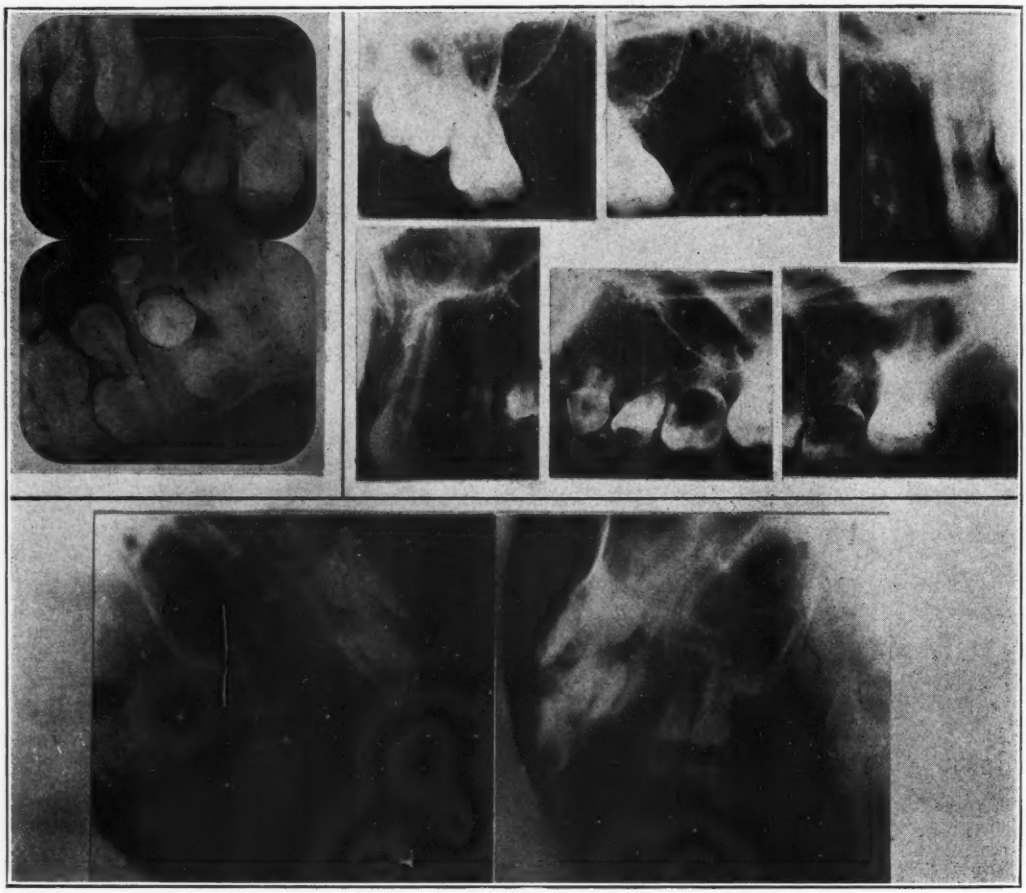

Fig. 20.

Fig. 18.—Supernumerary teeth.
Figs. 19 and 20.—Congenital absence of teeth.

similar cases, I am quite convinced this tooth would not erupt in a normal position without surgical interference. Surgery was performed, the cyst removed, and within a very few months the maxillary right permanent canine erupted normally without any orthodontic stimulation.

Fig. 14 shows a deflected mandibular second premolar resulting from the cystic formation about the roots of the mandibular second deciduous molar.

Fig. 15 shows dental adamantoma, in which some twenty-odd pieces of enamel organ were removed. Clinical evidence showed absolutely no abnor-

mality in this area, and the condition was found only through routine radiographic examination.

Supernumerary teeth are not at all uncommon, and they may appear in any part of the mouth in any given number. In Fig. 16 you will see some ten or more widely distributed supernumerary teeth in the palate of a patient. Fig. 17 shows a supernumerary tooth between the maxillary central incisors. It is a strange coincidence that many of these teeth grow upward as is shown in the radiograph, the enamel directed toward the nasal cavity. The deformity

Fig. 21.

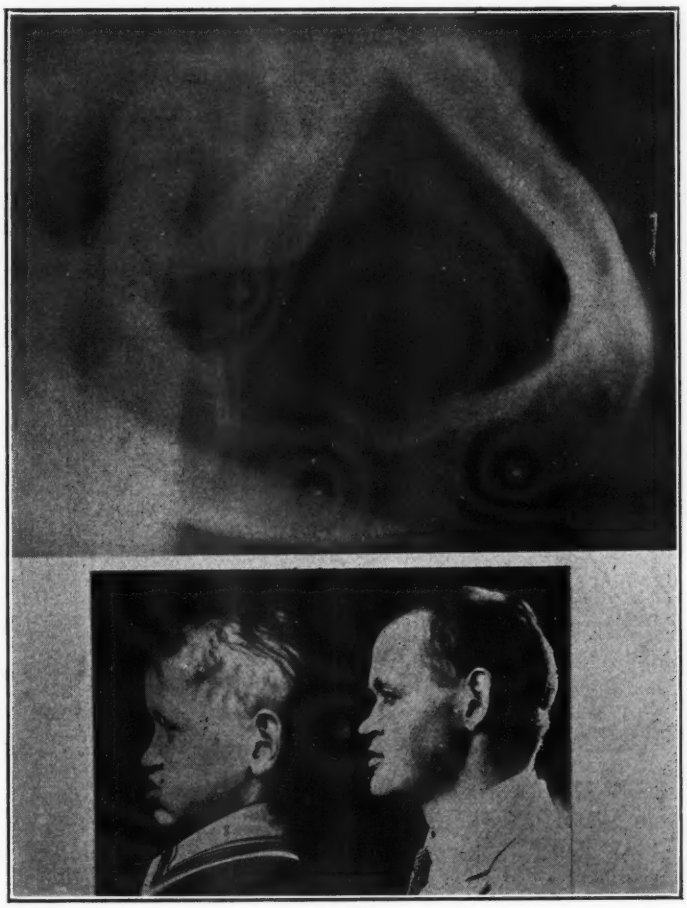

Fig. 22.

Figs. 21 and 22.—Anodontia. (Courtesy of Dr. K. H. Thoma.)

present is a typical example of malocclusion due to supernumerary teeth, which are frequently found in this region. Had the supernumerary tooth been recognized earlier, through a routine radiographic examination, the malocclusion necessitating orthodontic treatment could probably have been averted by the simple removal of the supernumerary tooth at the proper age.

The most interesting case of supernumerary teeth which has come to my attention is shown in Fig. 18. We have all had patients who have stated, with absolute sincerity, that their mother or grandmother had a third set of teeth.

I might have argued the point years ago, stating it was quite impossible as the dentition of man has but two sets. As a side remark to the patient, I might have said that if they did have a third set, it was their artificial denture. However, the radiograph of the patient shown in Fig. 18 has changed my attitude in this regard. Although, of course, I do not admit a third dentition to the human species, you will note a well-lined-up set of supernumerary teeth in the mandibular premolar region. You will note the second deciduous molar beneath which is a second premolar and beneath that another premolar. You will note that the first premolar is also followed by another premolar. You can well appreciate the fact that this patient might say, in absolute sincerity, that he had a third set of teeth, for, although the condition in this patient has occurred only in certain parts of the mouth, it might well occur—although I have never seen it—throughout the entire dentition.

Fig. 23.—Ankylosis. (Courtesy of Dr. V. H. Kazanjian.)

Congenital absence of teeth is not at all uncommon, and no individual tooth is immune from being congenitally absent. Statistics show, however, that the maxillary lateral incisors and the maxillary or mandibular premolars are those most frequently missing. In Fig. 19 you will see the congenital absence of maxillary permanent lateral incisors, canines, and premolars, and also one second permanent molar (it might also be interesting to note in this slide, the marked amount of root resorption on the deciduous teeth, with no permanent successors, a subject I shall discuss later in this paper).

There is a classification of cases with congenital absence of teeth which I would call to your attention (Fig. 20) and that is where we have the presence of the four first permanent molars, two maxillary anterior teeth (usually the central incisors) and two mandibular anterior teeth, either the central incisors

or the canines. Occasionally, with this combination, which I have seen several times, there are one or two additional molars and one or two additional mandibular anterior teeth.

Fig. 21 is the radiograph of the mandible of a child eight years of age, showing the complete absence of all teeth, deciduous and permanent. From a

Fig. 24.

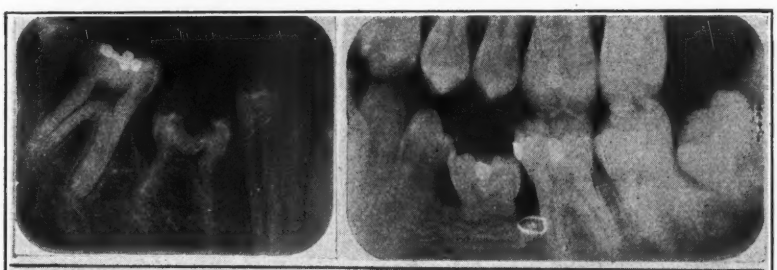

Fig. 25.

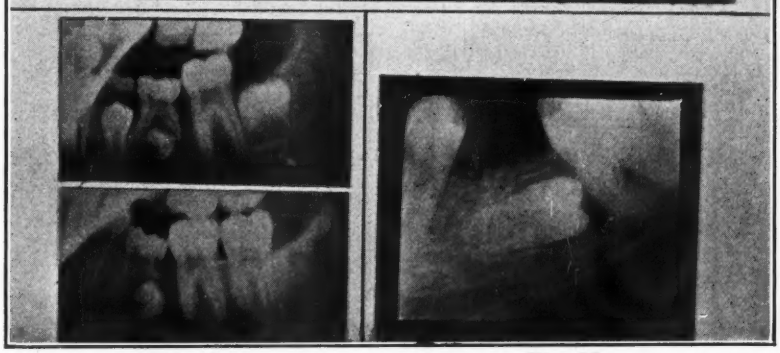

Fig. 26. Fig. 27.

Fig. 24.—Imbedding of deciduous teeth.
Fig. 25.—Imbedded mandibular deciduous molar.
Fig. 26.—Malposed tooth germs.
Fig. 27.—Malposed tooth germ.

most complete and interesting history obtained, it is a true case of "ectodermal dyscrasia" with complete anodontia. X-ray examination discloses

both the maxilla and the mandible completely edentulous. The size and shape of the mandible appear quite normal, thus disproving the old theory that its growth is dependent upon the development of the teeth. It should be noticed, however, that there is no alveolar process. Fig. 22 is the photograph of the boy at the age of eight and also at the age of twenty-four years. His appearance has been greatly improved by the use of artificial dentures, but radiographs taken again at this time show that during the interval of sixteen years no teeth have formed, and the case remains one of complete anodontia.

In Fig. 23 we have a typical case of ankylosis of the mandible of a young adult. The ankylosis occurred very early in life, due to an infection. Here we have the growth and the eruption of the mandibular teeth, yet the mandible remains quite undeveloped. Comparing this illustration of ankylosis with the previous illustrations of anodontia would lead to the conclusion that the function of motion is more important for the development of the mandible than the growth of the individual teeth, and that the growth of the teeth affects only the development of an alveolar process.

I would call your attention to the importance of observing the mandibular second deciduous molars. Not only, as already stated, are their permanent successors frequently congenitally absent, but also these teeth often have a tendency to wedge themselves downward into the mandible as shown in Fig. 24. I have seen these teeth where just the tip of a cusp remains showing, and in Fig. 25 you can see where the crown of a second deciduous molar is well imbedded in the body of the mandible with a large cystic formation surrounding it.

Malposed buds of permanent teeth are not infrequent. I referred before in my paper to the deflection of teeth by deciduous roots or overretained teeth, but as is seen in the upper radiograph in Fig. 26, the crown of the mandibular second premolar points slightly distal, without any apparent cause. Three years later, as shown in the lower radiograph, the tooth has continued to develop in a definite oblique position.

Fig. 27 shows a fully developed horizontal and impacted second premolar, a possible sequence of a condition described in Fig. 26.

Tooth germs may be malplaced, and in Fig. 28 you will see the maxillary right permanent canine erupting between the first and second premolars and the maxillary left permanent canine erupting between the maxillary left lateral incisor and the maxillary right central incisor. The radiograph shows the presence of a well-formed impacted maxillary left central incisor.

Malformed teeth or teeth fused together are not at all rare. In Fig. 29 may be seen a fusion of the maxillary right central and lateral incisors and also of the maxillary left central and lateral incisors. The two smaller teeth adjoining these teeth are the deciduous lateral incisors. In these fused teeth, the radiograph shows two pulp chambers and two distinct root canals. Fig. 30, rather an unusual case, shows two central incisors, each measuring approximately 14 mm. in width. This, however, is not a fusion of central and lateral

incisors, for both permanent lateral incisors are present. Fig. 31 shows casts and radiographs of these central incisors. These teeth have one large pulp chamber but have two distinct roots, a condition which I have not seen before. I often wonder, when seeing these malformed incisors, how those orthodontists who predetermine the shape of the dental arch entirely from the measurement of the two maxillary central incisors would do their plotting in these cases.

Fig. 28.

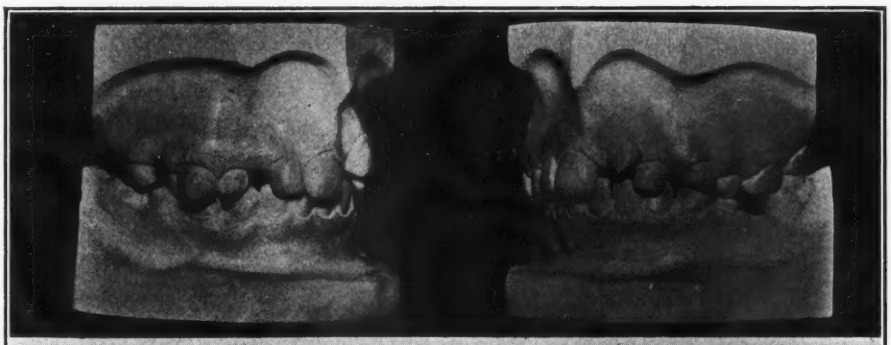

Fig. 29.

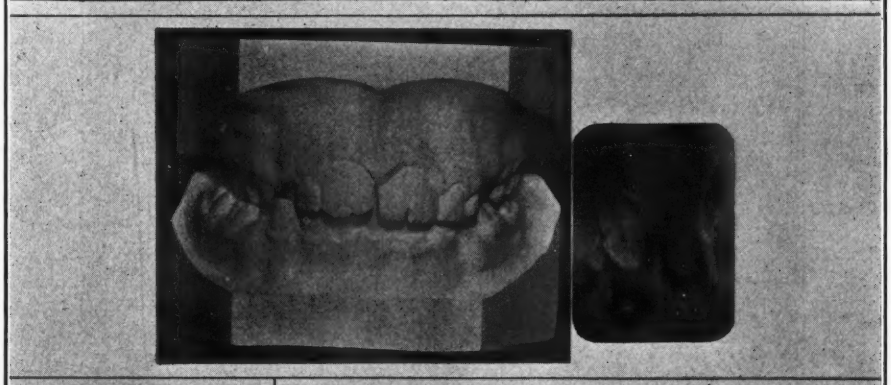

Fig. 30.

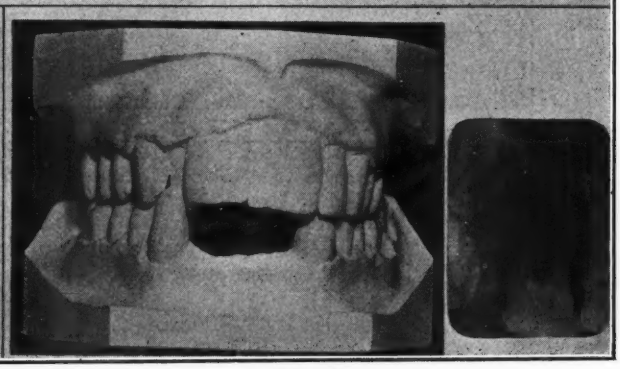

Fig. 31.

Fig. 28.—Transposed teeth.
Fig. 29.—Fusion of teeth.
Figs. 30 and 31.—Abnormal central incisors with two roots. (Courtesy of Dr. G. W. Lawrence.)

Cleft palate and harelip abnormalities come well within the scope of the orthodontist. Not necessarily from the standpoint of operating, but from the service which we may be able to render these dental cripples if taken at the proper age—and from the influence we may be able to have upon the surgeon operating for these children. It has been my pleasure and privilege to study

and care for a large number of cleft palate children over a period of many years, and I can assure you that the radical change in the technic of operating on these cases by the progressive surgeon has been greatly influenced by his dental colleagues, and is most gratifying. Originally the great aim of the

Fig. 32. Fig. 33

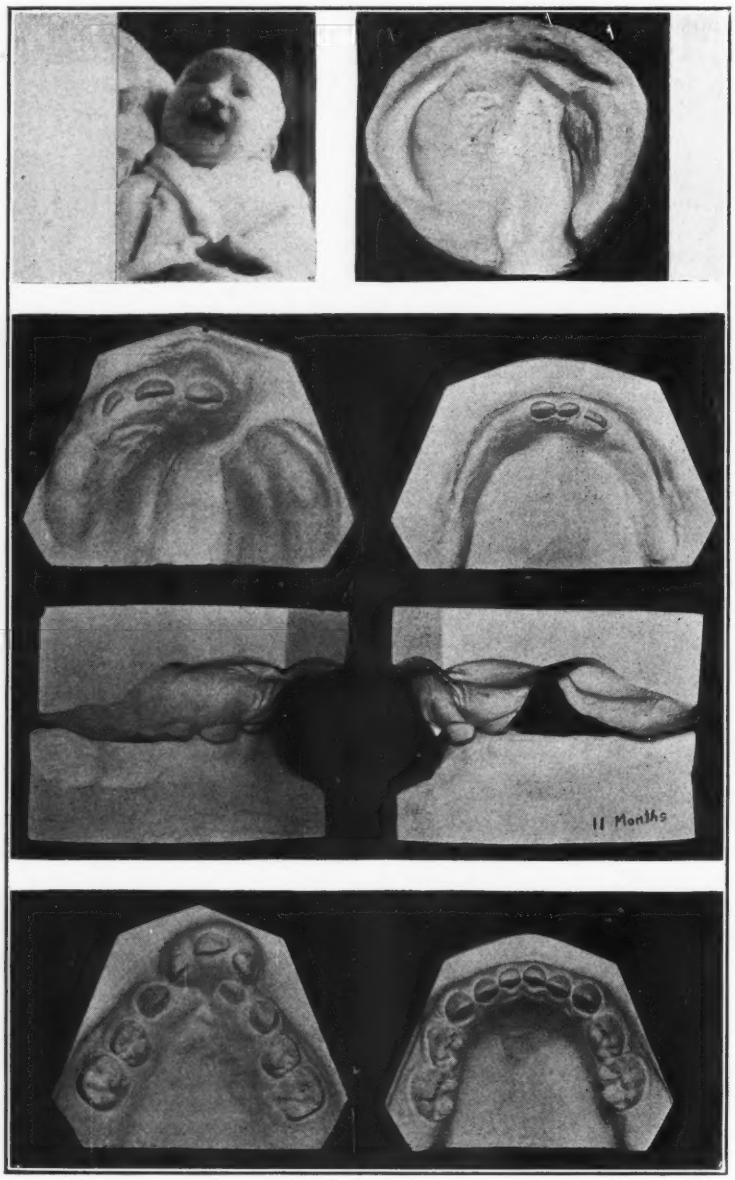

Fig. 34.

Fig. 35.

Figs. 32-35.—Cleft palate. (Figs. 32 and 33, courtesy of Dr. H. H. Germain.) (Fig. 34, courtesy of C. G. Mixter.)

surgeon was to close the lip and to close the hard palate, disregarding entirely the problem of occlusion in later life. These children, at the time of the operation, had what was then considered a successful operation with a beautiful esthetic result, but, invariably as the child grew older, the deformity grew worse with marked facial disfigurement. Today the surgeon recognizes

the importance of functional occlusion and the palate is operated on accordingly. Figs. 32 and 33 show a child with a cleft palate and harelip at the age of six weeks, before operation. Fig. 34 shows a case in which a most sensible palate operation was performed. The cleft in the hard palate has been closed but slightly. The contour of the maxilla has been retained in the best judgment of the operator and, as can be seen, at the age of eleven months

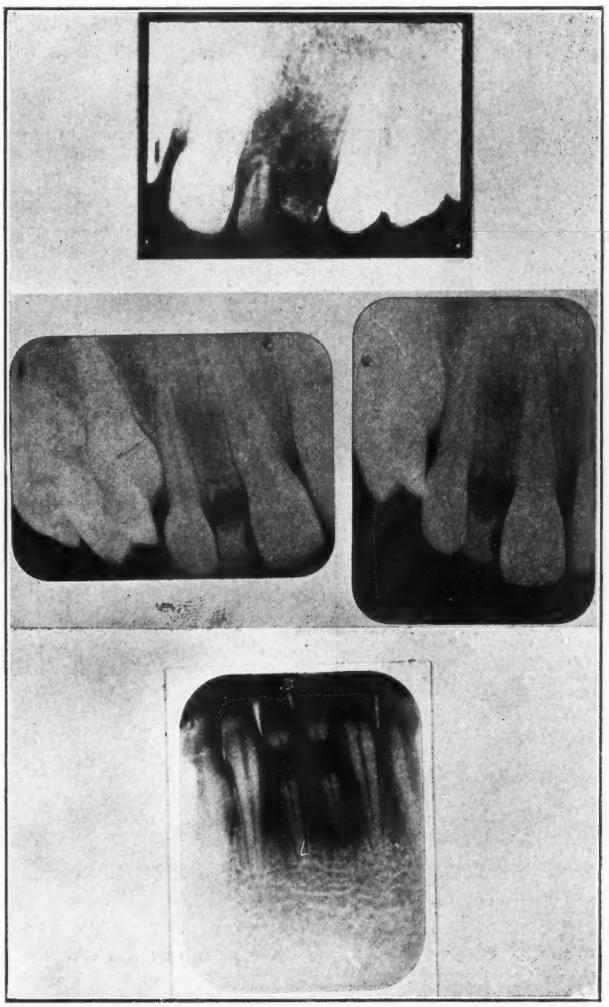

Fig. 36.

Fig. 37.

Fig. 38.

Figs. 36 and 37.—Resorption of deciduous roots without permanent successors.
Fig. 38.—Resorption of permanent roots. (Courtesy of Stillman Infirmary of Harvard University.)

the teeth are erupting very well. There has been no marked collapse of the maxilla. At this time a second operation will be performed to further close some of the cleft.

Compare Fig. 35 in which the maxilla has been collapsed, yet not nearly so badly as some which I have seen, with that of the previous case. You will note here how function has been seriously interfered with, and the prognosis is not so favorable as that of the previous case.

The resorption of teeth, both deciduous and permanent, is a process about which we know very little and which offers a tremendous field for research. It had been thought that the deciduous tooth roots were resorbed by the pressure of its permanent successor, yet in Fig. 36, we find the complete resorption of the deciduous canine root with no permanent successor present. Again we have many deciduous teeth which have permanent successors with absolutely no resorption of the root. Then again we find the resorption of roots, both of the deciduous and of the permanent dentitions, in various degrees and in various positions of the individual root. Sometimes it is at the apex, some-

Fig. 39. Fig. 40*A*.

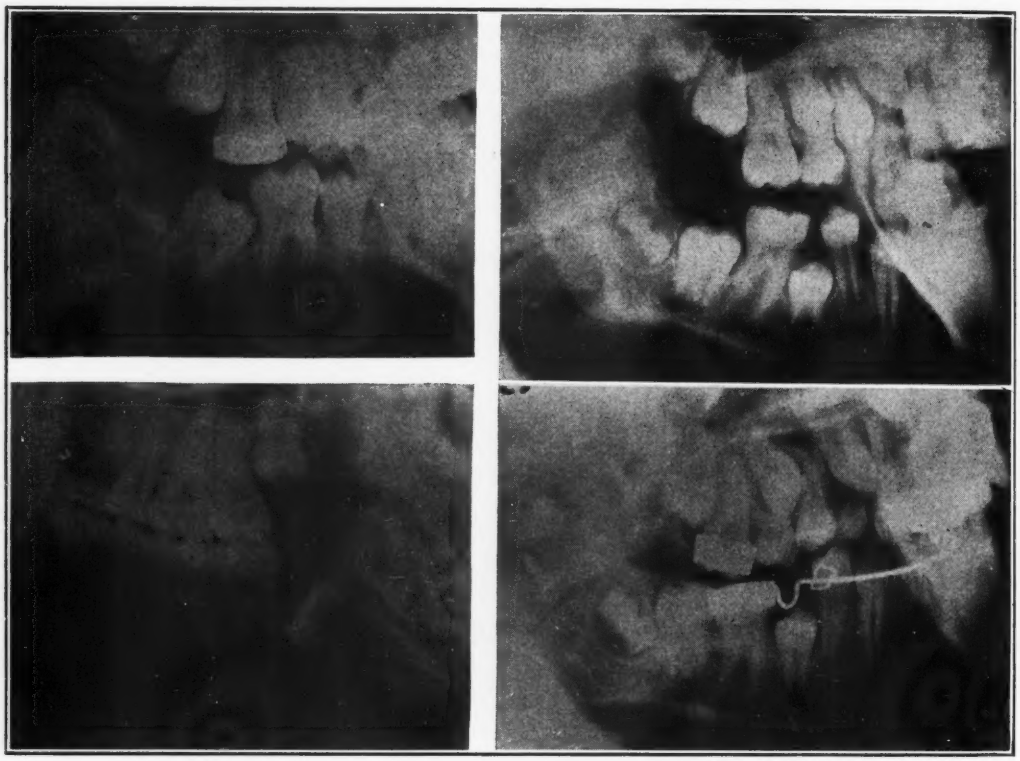

Fig. 41. Fig. 40*B*.

Fig. 39.—Impaction of second permanent molar.
Fig. 40.—Impaction of molars due to improper manipulation of orthodontic appliances.
Fig. 41.—Impacted third molar.

times on the side of the root, and occasionally in the middle section completely separating the apex from the rest of the root. Although I can offer no authentic proof, in my opinion, root resorption is a problem in which the constitution of the individual is an important factor and in which the ductless glands may also be involved.

Fig. 37 shows the resorption of the middle section of a deciduous root, the apex being practically separated from the rest of the root.

Fig. 38 shows the resorption of the middle section of the roots of two permanent central incisors, and I am quite relieved and happy to say that this

patient has never had any orthodontic treatment to which the resorption might be attributed.

The question of impacted teeth is sometimes underestimated. Too often we visualize impactions of only canines and third molars, but in Fig. 39 you will see a definite impaction of the mandibular second permanent molar, a condition which, in my investigations, I have found not at all unusual. The etiology of this condition is quite obscure, and yet, in some cases, it may be due to a malposed tooth germ as previously described. On the other hand,

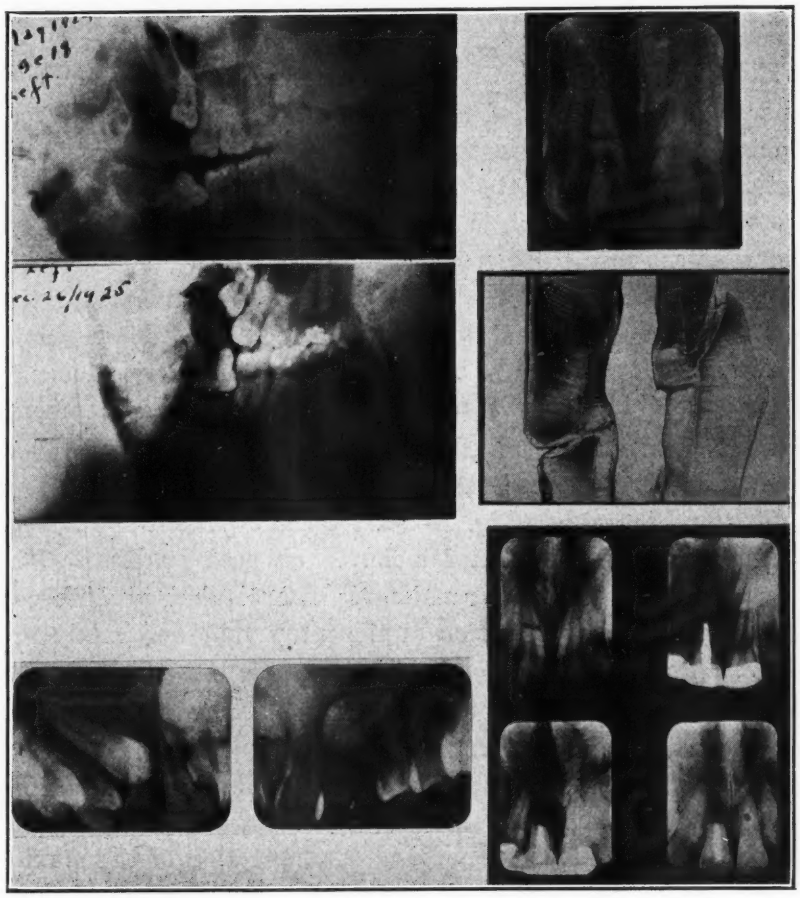

Fig. 42.

Fig. 44.

Fig. 45.

Fig. 43.

Fig. 46.

Fig. 42.—Progressive impaction of mandibular third molars.
Fig. 43.—Impacted canine teeth.
Fig. 44.—Fractured root.
Fig. 45.—Histologic section of fractured root. (Courtesy of Dr. P. R. Howe.)
Fig. 46.—Fractured root, with apex removed, showing filling in of bone and newly formed lamina dura. (Courtesy of Dr. M. S. Strock.)

in Fig. 40*A* may be seen a definite explanation for the impaction of these mandibular second and third molars. It was caused by my improper manipulation of an orthodontic appliance. You will note the condition present in the upper radiograph before any orthodontic treatment was rendered. There was insufficient space for the mandibular second premolar to erupt, and a lingual appliance was inserted as shown in the lower radiograph (Fig. 40*B*) to open the space to

permit the normal eruption of this tooth. The application of force certainly opened the space for the successful eruption of the mandibular second premolar, but the first permanent molar was tipped distally. This, in turn, disturbed the second permanent molar, and the force exerted by this tooth caused a definite impaction of the mandibular third molar. This experience, although costly as all experience is, was a great lesson to me and guided my future manipulation of orthodontic appliances more carefully. Let me emphasize the fact, however, that the impactions were not caused by the type of appliance used, for it is a most useful one, but were caused entirely through improper manipulation of it by the operator.

As I stated in the first part of my paper, I have long contended that many so-called impacted third molars were really normal for that age at which the diagnosis was being made, and as the maxillae developed, the teeth would assume their proper position in the dental arch. However, we do have early manifestations of some impacted third molars, and when we are convinced that these teeth are impacted, they should be removed at an early age and before the roots are formed in order to simplify a future operation. You will note in Fig. 41 the inclination of the crown of the mandibular third molar which is, in my opinion, eventually to become impacted and should be removed. This, of course, is only based on my personal experience, and I believe some men might rightfully prefer waiting further development.

If these teeth are not removed, they may become progressively worse and cause undue pressure against the distal surfaces of the second permanent molars. These radiographs (Fig. 42) of the same patient show a progressive impaction of the mandibular third molars. I would emphasize here that in your study of these cases, where radiographs are taken at different periods, it is imperative that the angulation of the x-ray tube be exactly the same in all instances, otherwise it may lead to a faulty diagnosis.

Impacted canine teeth are quite common. They may be due to many causes, among which are the premature loss or the overretention of the deciduous canine. In the radiographs in Fig. 43, which are of the same patient, the maxillary left permanent canine is impacted, probably due to the premature loss of the deciduous canine, and the impaction of the maxillary right permanent canine is due, possibly, to a pathologic condition of the maxillary right deciduous canine. Note the marked resorption of the root of the maxillary right permanent lateral incisor, a condition we must always be careful to observe with impacted canine teeth. There may, of course, be other contributory factors in this case.

Traumatic injury to permanent central incisors is quite frequent. In Fig. 44, the radiograph shows a central incisor which was injured by a hockey puck and the root of which has been completely fractured. The treatment of such cases varies with conditions found present. In this case, a splint was placed on the fractured tooth and the adjoining teeth to immobilize the injured incisor. The diet was modified to prevent unnecessary use of the maxillary anterior teeth. The tooth was vital and had not discolored, and

the pulp was not removed. At this time, five years after the accident, the tooth is still in excellent condition, it is vital, it has not discolored, and has never given the patient any trouble. It has always been a question as to whether or not there is any uniting of the root in fractured teeth, and Fig. 45 shows that the two segments in this case have been united by newly formed dentine. It must be explained, however, that in this case the tooth remained vital for several months.

A case of root fracture in which devitalization of the tooth was necessary and a different procedure was followed is shown in Fig. 46. These are four very interesting radiographs of the same tooth at different periods. The first radiograph shows the fractured incisor immediately after the injury. The second radiograph shows the tooth splinted to the adjacent teeth and the root canal filled. Immediately after this radiograph was taken the apex was removed. In the next radiograph, taken three months after the accident, may be seen new bone filling in the cavity and the appearance of the lamina dura now forming. In the fourth radiograph, four months after the original injury, can be seen a vast amount of new bone filling in the cavity and now a well and beautifully formed lamina dura covering the present apex of the root.

In conclusion, as you are now aware, it was not the purpose of this paper to solve the many perplexing problems which arise in the treatment of orthodontic cases, but rather to show: (1) the necessity for obtaining a complete history of the child and learning the possible causes of his abnormality exhibited by clinical observation or by radiography; (2) sufficient evidence why orthodontia should be viewed from a broader perspective than that of merely moving individual teeth; (3) the necessity for further study and research in the etiology of dental abnormalities; (4) the need for realizing and admitting frankly the limitations of an orthodontist especially when Nature has failed to supply the child with sufficient or normal tissues; (5) the aim of an orthodontist should be to try to control the growth and development of the dental apparatus of the individual patient in a practical manner, and that this should and must be governed by that invaluable knowledge and skill, acquired only by experience and judgment which in the end is only "good common sense."

DISCUSSION

Dr. Lowrie J. Porter, New York City.—I was very much interested in hearing Dr. Blumenthal speak particularly about the impacted third molars, because it seems to me that is a very vital thing for us and a responsibility for which we as orthodontists have to answer. There is no question that we have to take x-ray pictures before treating a patient. Many patients are dismissed from an orthodontist's practice without x-ray pictures being taken when the treatment is finished. I have found many cases in which we have regulated the teeth, where they have gone out of place afterward, probably from the pressure of the erupting third molar, and have seen cases in which the patient reported regular teeth until the time of eruption of the third molar, and then had the anterior teeth go out of position. This may or may not have been from the pressure. I was led to believe it was.

Referring to the x-ray picture Dr. Blumenthal showed, I believe he was not right in extracting at that time because I have seen a lot of cases which looked as though they were going to be impacted, which have come out all right eventually. If we have followed the cases up and found them not to come up all right, it is our duty to retain the

teeth until the third molar has erupted or been taken out, or the patient has been informed that this cannot possibly be a source of trouble, and we have been in touch with the dentist so that the dentist will keep track of that in the future.

A lot of our work, it seems, is destroyed because of our lack of going ahead on that. I am following the patient and the dentist and watching it until such time as we believe it is safe to remove our appliances.

Dr. Sidney E. Riesner, New York City.—I am asking this question because of the stimulation it may bring to other members. One of the faces that Dr. Blumenthal presented showed the submerging molar. I have been interested in that for quite a few years and have been gathering data on that, and on the cases we have recorded there is always, it seems, some sort of trauma which has been mentioned at an early age in the eruption of that tooth. It seems peculiar for the reverse to take place, for this tooth to submerge rather than to exfoliate normally, and I should like to ask Dr. Blumenthal whether he will check up on the cases he comes in contact with, or can he tell us at this time what his experience has been, whether there has been some trauma through excessively erupting deciduous second molars in the maxilla, which will produce a pressure on the distoclusal surface of the lower deciduous molar which is submerging. By that means it might occur, or the force may be a sudden one by trauma, by falling against the radiator or the milk bottle, or one of occlusion where there is excessive eruption of the upper maxilla.

Dr. Frederick B. Noyes, Chicago.—In regard to the submerging second, I should like to ask Dr. Blumenthal if the radiographic evidence indicates in any way that it was similar to the condition described of submerging deciduous molars. I have been very much interested in this thing for a good many years, and two or three years ago I succeeded in getting material which showed what was happening in the case of the submerging deciduous molars. I never have been fortunate enough to get any material from the permanent molars. I have seen submerging first permanent molars but never a second. I am sure that it probably occurs with the second, but from the evidence already in hand, probably in all of those cases there is a true ankylosis and the reason the tooth appears to be submerging is that it ceases to move occlusally in its normal way, being locked to the bone by an interlocking of bone and dentine which is characteristic of ankylosis.

The etiology of the thing, so far as I am concerned, is entirely obscure. I do not know how many cases I have had to study, but it is quite a considerable number, and there was no traumatic history in any of them. I have suspected because of the similarity of appearance and tissue reaction that these things may have an explainable etiology, but I do not think it is safe even to say it out loud. The fact, however, is that you have appearances here which are characteristically found in the hypophysectomized animals of Schour's experiments. I have felt like expressing it that in all normal reaction there is a certain rhythm which is comparatively slow rhythm, but in these tissues there is this sort of rhythm (indicating) between absorption and reformation. The areas of absorption and reformation are very close together. The alternations between construction and destruction apparently are at short intervals, and the result is an interlock of bone and dentine and cementum which fastens the tooth and fixes it in its relation to the mandible or maxilla.

I ask that question of Dr. Blumenthal because our hindsight is always better than our foresight; but after finding the histologic picture, I have found that I can almost always see the structural picture from the x-ray picture. There is a loss of outline of the triple form plate or the lamina dura. There is a moth-eaten appearance of both bone and tooth root and that is simply the x-ray picture of the interlocking of the tissues. After the histologic picture was worked out, I went back over the radiographs of all the cases I had had and the radiographic history of those of other people, and almost invariably the appearance could be checked in the radiograph.

Dr. Baker.—I want to say just a word or two of appreciation regarding Dr. Blumenthal's very fine paper. You know perhaps (the teachers know anyway), that when one of our pupils does something, we are inclined to assume that it is all our work, but it is not so

at all. Dr. Blumenthal is a hard worker and he is working in a broad way. He is working in one of the great scientific centers of the world, and his presentation is the result of years' accumulation.

Dr. Blumenthal.—Dr. Riesner's question was as to whether the trauma caused the submerging of the second deciduous molars. That is something I have not thought of before and which I shall investigate, but I have found that submerging of the second deciduous molars may be attributed to early tongue habits.

There is one other condition which I am quite sure has caused submerging of the second deciduous molars—I rather hesitate to say it on account of Angle's old theory that the first permanent molars never vary in the position in the skull. I am inclined to disagree with that because I think they can vary and I have seen first permanent molars, long before eruption in the oral cavity, being mesially displaced as shown by radiograph, and I firmly believe that might have an influence on the submersion of a second deciduous molar.

In regard to Dr. Noyes's question as to submerging permanent molars and the impaction of second permanent molars, he has investigated much more thoroughly than I, and his reasoning is so good I am perfectly willing to accept at the present time the status of his explanation until further study. I should say definitely in two specific instances of submerged or unerupted permanent molars that they occurred in two children in each of two families. In one family the older girl was fourteen, and when the next child came to me a few years later, she had exactly the same condition. We will not go into heredity, of course, but I found the condition in two different families.

I shall certainly profit greatly by your suggestion of a more thorough investigation of the conditions histologically.

DENTAL RESEARCH AT THE NATIONAL BUREAU OF STANDARDS IN RELATION TO ORTHODONTIA*

GEORGE C. PAFFENBARGER,† D.D.S., AND WILLIAM T. SWEENEY,† A.B.,
WASHINGTON, D. C.

SINCE 1928 the American Dental Association has been cooperating with the National Bureau of Standards in the study of dental materials and technics. Prior to this time this work was conducted by the federal government alone and with the cooperation of the Weinstein Research Laboratories.

Policy.[1] The chief purpose of the work is the development of satisfactory standards for dental materials. This is accomplished by: (1) buying in the open market standard trade brands of materials; (2) determining those physical-chemical properties which are of importance in relation to their dental uses; (3) formulating tentative specifications using these surveys as a basis. The tentative specifications are submitted to dental schools and manufacturers for their suggestions. They are then presented to the Research Commission and the House of Delegates of the American Dental Association for consideration and approval, after which they become the official specifications of the Association. To the present time seven such standards have been adopted, namely, those for amalgam, inlay casting investment, impression compound, inlay casting wax, inlay casting gold, dental mercury, and wrought gold wire. The eighth, for zinc phosphate cement, is now being formulated. These specifications are subject to revision as new and improved materials are developed.

Following the adoption of the specifications, the Research Commission invited manufacturers of the materials concerned to certify formally that their products would conform to the specified requirements. Lists of these certified products have been published from time to time in the *Journal of the American Dental Association,* the most recent list appearing in the April, 1934, issue.[2] As a further protection to the dentist, manufacturers are encouraged to place a statement upon the packages of materials guaranteeing conformity to the Association's specifications.

As time and personnel permit, materials bearing a guarantee statement involving the Association's specifications will be purchased and tested by the Association's Research Fellowship at the National Bureau of Standards to determine whether the product complies with the guarantee. So far such surveys have been made on amalgam, inlay wax, and impression compound.

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*Publication authorized by the Executive Board of the Research Commission.
†Research Associate of the American Dental Association at the National Bureau of Standards.

The results have been published in the *Journal of the American Dental Association.* Such a program enables the dentists to buy materials of known quality and performance.

WROUGHT GOLD WIRE

The studies that have been made of wrought gold alloy wire are possibly of most interest to the orthodontists.[3, 4] Physical properties of the wires were determined in three conditions: (1) as received; (2) quenched (softened); (3) heat treated (hardened). A specification was formulated using the foregoing studies as a basis. This specification contains certain requirements for chemical composition and physical properties. The reasons for the selection of these particular properties, together with the specific values assigned to them, and an interpretation of their practical usefulness to the orthodontist in routine office procedure will be discussed.

The requirement that the wire must contain a minimum of 75 per cent by weight of gold and the platinum group metals was included in the specification primarily as a protection against discoloration in the mouth. Fifteen of the eighteen brands analyzed met this requirement.

The minimum fusion temperature permitted is 1,750° F. This is approximately 200° F. above the melting point of solder for 22 carat golds and with careful soldering technic should provide ample protection against seriously injuring the wire in soldering.

Tensile strength, elastic limit, and elongation before fracture (in a tensile test) are of utmost importance in determining the usefulness of the wires. Tensile strength is the stress supported by the wire when it breaks in a tensile test. It is always expressed as pounds per square inch calculated on the original cross sectional area of the wire. Elastic limit is a measure of the amount of deformation the wire will stand without being permanently deformed after the applied stresses are released. Lack of "springiness" in a wire is evidence of a low elastic limit. However, as doubt exists that any material is truly elastic if sufficiently refined, measurements of deformation are made; "elastic limit" (in tension, for example) should be defined, for specification purposes, as the maximum stress the wire will support without acquiring a permanent elongation in excess of the specified amount. There are various acceptable methods for expressing this amount but they need not be discussed here. Elongation in a tensile test is the increase in length of the specimen when fractured. It is generally expressed as the percentage increase in length of a specified gauge length when the fracture has occurred within the gauge length.

To comply with the specification the wire in the "oven-cooled" condition (this condition will be discussed in the following section) must have a tensile strength of at least 150,000 lb. per square inch. This is believed to be adequate for orthodontic uses. The wire must also have an elongation of not less than 15 per cent in the "quenched" condition and not less than 4 per cent in the "oven-cooled" condition, both measured on a 2-inch gauge length. Wires which have at least 15 per cent elongation in the "quenched" or softened condition are sufficiently soft and pliable to be formed without

injury. Likewise, if they have at least 4 per cent elongation in the "oven-cooled" or hardened condition they are not likely to be unsatisfactorily brittle when subjected to heat treatments, either accidentally or intentionally.

As the determination of an elastic limit is difficult, the stress to produce a more easily determined permanent elongation and defined as "yield point" has been included in the specification. Laboratory experience in working with these materials has shown that wires of approximately the same chemical composition and previous mechanical treatments may have considerably different yield points depending upon their thermal treatment. Those having a relatively high yield point are the most satisfactory in orthodontia.

Heat Treatment

Most of the wires currently used respond to heat treatment. In the specification tests for wire in the quenched condition the wire is heated to approximately 1,300° F. and quenched in water at room temperature. In this condition it possesses a low tensile strength, a low elastic limit, a very high elongation, and is said to be "soft." It is easily formed. It possesses almost no "springiness" and is in the proper condition for manipulation. By an appropriate heat treatment the wire can be converted into one possessing a high tensile strength, a high elastic limit, and a medium elongation. A wire in this condition is often spoken of as "hard," "tough," and "springy," and thus has the properties which are desired in service. By an inappropriate heat treatment some wires will have their elongation reduced to almost zero. Then they are found to be brittle.

In the specification tests for wire in the oven-cooled condition, the quenched wire is placed in a furnace at 840° F. and cooled at a uniform rate to 450° F. in one-half hour. Unless the dentist possesses a furnace with such a cooling rate it would be better, probably, to heat the wire at a definite temperature for a definite time according to the manufacturer's directions.

Probably the most convenient and at the same time the least expensive equipment suitable for heat treating dental appliances is a salt bath. For many years various mixtures of salts have been used in industry for this purpose. Potassium nitrate (KNO_3), and sodium nitrate ($NaNO_3$) when mixed in equal proportions by weight, melt to a straw-colored liquid at approximately 400° F. The only additional equipment necessary is a Bunsen burner, a tripod, a heavy metal pan for holding the salts, and a short-stemmed mercury thermometer which will read to 750° F. One distinct advantage in the use of this bath is the prevention of oxidation of the appliance during the heat treatment. It can be used repeatedly without deterioration. Certain precautions must be observed in its use. The appliance must be absolutely dry when placed in the hot liquid as any moisture introduced with it will form steam, spraying the hot liquid with explosive violence. All organic materials such as waxes must be kept away from the bath because of danger of an explosion. Aside from these two precautionary measures, the material is almost mistake-proof. The equipment can be procured from a laboratory supply company and some dental supply houses and is inexpensive.

The difference in the properties of the wire in the quenched or softened condition and in the oven-cooled or hardened condition is so great that it is easily detectable by the feel of the wire in the hands. The vast differences in the physical properties of springs made from wires of the same composition but subjected to different heat treatments can easily be demonstrated. Two straight pieces of 0.020 inch wire, 6 inches long, are softened by quenching. One of these wires is then given a hardening heat treatment in accordance with the manufacturer's directions. The softened and hardened wires are then bent into a loop, as illustrated in Fig. 1 (II), and released. The softened wire will be found to have acquired a much greater "set" than the hardened wire. This experiment is qualitative. A quantitative method for such a test was described by Coleman in Bureau of Standards Research Paper No. 32.[3]

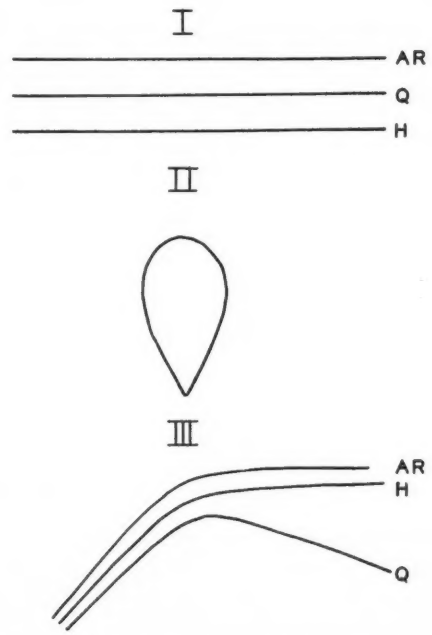

Fig. 1, I.—Three pieces of gold alloy wire 0.020 inch in diameter and 6 inches long. *AR*, As received condition. Elastic limit 112,000 lb. per sq. in.; *Q*, quenched—heated for ten minutes at about 1,300° F. and quenched in water at room temperature. Elastic limit 84,000 lb. per sq. in.; *H*, hardened—uniformly slow cooled in one-half hour from 840° F. to 480° F. Elastic limit 120,000 lb. per sq. in.

II.—All three wires bent into a loop simultaneously.

III.—After releasing, wire will take different sets depending upon its condition—*AR*, as received, *Q*, quenched, *H*, hardened.

Since the physical properties of the wire can be profoundly changed by the manner and degree of heating, it is well to consider the current methods of using the wire. Many orthodontists use the wire in the same condition in which it is received from the supply houses. This condition may vary over rather wide limits depending upon the thermal and mechanical treatments it received during the process of manufacture. Most manufacturers finish their wires with a considerable amount of cold-work hardening because many orthodontists test the wire by noting its springiness when flexed between the thumb and the fingers. If the wire is soft and takes a set with comparative ease, it is considered unfit for most orthodontic purposes and would be given an inferior rating by such a flexure test. Some operators do not soften the

wire before forming, since such a procedure removes most of the effect of the cold working. However, the cold-worked condition is largely removed in the spots which are heated in soldering. Therefore the condition of the wire in many appliances is a mixture of cold worked, softened, and hardened sections depending upon the soldering and fabricating technic employed. Often the point which must bear the greatest stress is unfortunately in the soft condition. Possibly the most rational technic should include a softening heat treatment; that is, quenching, so that the wire may be very pliable and easily shaped. After forming, the soldering should be carried out at the lowest possible temperature, to avoid injuring the wire. Following the fabrication, an adequate heat treatment which will restore the "springiness" of the wire should be used.

ZINC PHOSPHATE CEMENTS

Since the zinc phosphate cements are so widely used in orthodontia, perhaps the preliminary report[5] on them is of more interest to the orthodontist than the reports of the work on other materials. Clinical experience has shown that these cements are none too satisfactory in service because of their tendency to dissolve and disintegrate. Methods of mixing and using these cements profoundly affect their ability to prevent failure in service as shown in the report. It is therefore very important that they be mixed and used in the most rational manner.

The first problem which confronted us in the experimental work was the necessity of devising a controlled technic which would produce uniform test specimens and at the same time be a rational procedure for the dentist. The mixing technics of the manufacturers which accompanied the packages of cement were not satisfactory for the purpose. It is necessary to specify the proportion of powder to liquid, the type and temperature of slab, the time of mix and rate and method of powder incorporation. It was found that adherence to the procedure developed would produce uniform test specimens and at the same time was in harmony with current dental practice.

The time of set, the crushing strength, the dimensional change on setting and other physical properties were measured on seventeen brands of cement. Varying conditions of time, humidity and temperature were found to have a very marked effect upon these properties.

The powders and liquids of all the cements were analyzed. The major constituent of all the powders, with one exception, was zinc oxide. Sometimes modifiers such as bismuth oxide up to 4.5 per cent and magnesium oxide up to 13 per cent were added. The cements using a powder composed almost wholly of zinc oxide had some inferior qualities, such as low crushing strengths or marked disintegration in distilled water.

Some cements were uniform in behavior for all colors; others were not. In those cements which were not uniform the yellow colors were slower setting and usually stronger. This can probably be attributed to the greater degree of calcination to which these particular powders were subjected.

Additional properties, such as density of powder, disintegration, and solubility in various media, have been studied during the past year and will be reported in detail at the August, 1934, meeting of the American Dental Association.[6]

It was found, for instance, that the denser powders which have often been considered superior, seemed to produce cements which were slow setting, which disintegrated rapidly, and which had low crushing strengths.

Some of the zinc phosphate cements were said to be hydraulic, that is, they would set under water. All of the cements which were tested will do this, but it practically ruins their usefulness, because the water will leach some of the phosphoric acid from the unset cement. The result is a weak and permeable cement.

The powder, in a mix of normal consistency, is partially dissolved by the liquid, and the remaining powder is incorporated in the mix in much the same manner as are pebbles in concrete. The matrix which binds these unattached portions of the powder together apparently is dissolved away comparatively rapidly. This loosens these particles of powder, causing disintegration of the cement. Some of the cements disintegrated much more rapidly than others when they were immersed in distilled water and in both synthetic and natural saliva.

A specification for the zinc phosphate cements is now being written. It will include tests and definite numerical requirements for consistency of mix, setting time, crushing strength, disintegration, and film thickness. It is to be hoped that the manufacturers will guarantee their cements to comply with the specification after its adoption by the American Dental Association.

Practical Laboratory Tests

If any dentist should desire to conduct practical laboratory tests on cements of this type the following suggestions are offered:

As the exact repetition of mixing technic is necessary in the preparation of test specimens, an analysis must be made of each individual experimenter's method of mixing. This can conveniently be done by placing 30 grains (1.95 grams) of powder upon one end of a heavy glass slab, which has been previously chilled or heated, depending upon the temperature of the room, to about 70° F. The powder is then shaped into a rough square with the spatula and the square subdivided approximately into quarters, eighths, or sixteenths according to the personal choice of the experimenter. Eight minims of liquid (0.5 c.c.) are withdrawn with a hypodermic syringe and ejected on the slab. The cement is then mixed to the consistency used for cementing appliances in place. The time of mixing and the rate of powder incorporation are noted. The weight of the unused portion of powder is subtracted from the weight of the original amount of powder. The result is the amount of powder normally incorporated in 8 minims (0.5 c.c.) of liquid. A comparison of various brands of cement may show that some cement liquids will incorporate more powder than others. One cement was found to use 18.5 grains (1.2 grams) of powder

in 8 minims (0.5 c.c.) of its liquid while another would take only 5.5 grains (0.35 grams) in its liquid. Yet both cements were of the same consistency at the end of three minutes.

The maximum amount of powder that will permit the proper plasticity and setting time is always to be preferred, since such a mix will have greater crushing strength and will withstand disintegration better than mixes containing less powder. This ability to resist disintegration becomes very obvious when mixes of varying powder-liquid ratios are placed in water or in saliva. The relative turbidity of the water or saliva will give some indication of the degree of disintegration.

Such laboratory tests can be verified by clinical check tests. For instance different brands of cement and different consistencies of mix can be used on opposite sides of appliances and the conditions observed after several months of service in the mouth.

Other practical laboratory tests which can be performed in the dentist's own laboratory are now being executed by a group of practitioners cooperating with the Research Commission of the American Dental Association. If these tests prove to be of practical significance, the results of these and of the cooperative committee's tests will be published in the *Journal of the American Dental Association.*

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MAXILLARY PROTRACTION AND MANDIBULAR RETRACTION

RICHARD LOWY, D.D.S., NEWARK, N. J.

THE title of my case report, namely, "Maxillary Protraction and Mandibular Retraction" may be confusing to those of my listeners who are unfamiliar with the Simon method of gnathostatic and photostatic diagnosis.

Therefore, before I discuss the case at hand, I should like very much to enlighten that particular group on some of the salient points so that they might more intelligently follow my diagnosis.

Fig. 1. Fig. 2.

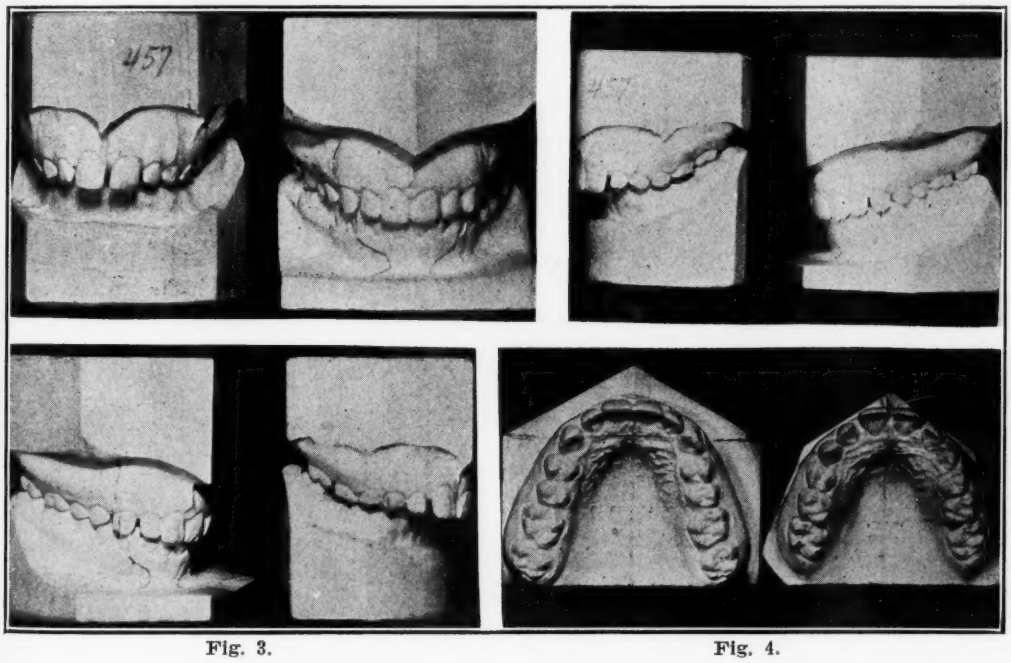


Fig. 3. Fig. 4.

Simon realized that our problem was a biological and not a mathematical one. Therefore when he orientated the denture to the skull by means of the three plane system, he realized that it was impossible to map absolutely and accurately the planes on a living patient; therefore he resorted to what he called fiction. Fiction applied here is interpreted as a hypothosis which is not verifiable but is employed for utility.

A perfect normal denture does not exist in nature, but by means of our conception we really comprehend it; thus we see that Simon's norm concept is based upon fiction.

Read before the New York Society of Orthodontists, November 20, 1933.

In simple language Simon defined orthodontic diagnosis as, "A search for, or determination of, the difference between the existing denture of a patient and the condition to be established."

The planes that Simon uses are:

1. The ear-eye plane, from the orbitalia to the tragus.
2. Orbital plane at right angles to the ear-eye plane.
3. The raphe median plane.

His system then changed the models of a denture from one of isolation to a definite anatomic part of the body in direct relation to the skull as a whole. By means of his graph curves the planes could be studied with ease. His photostatic photograph permits ease of interpretation of existing malformations.

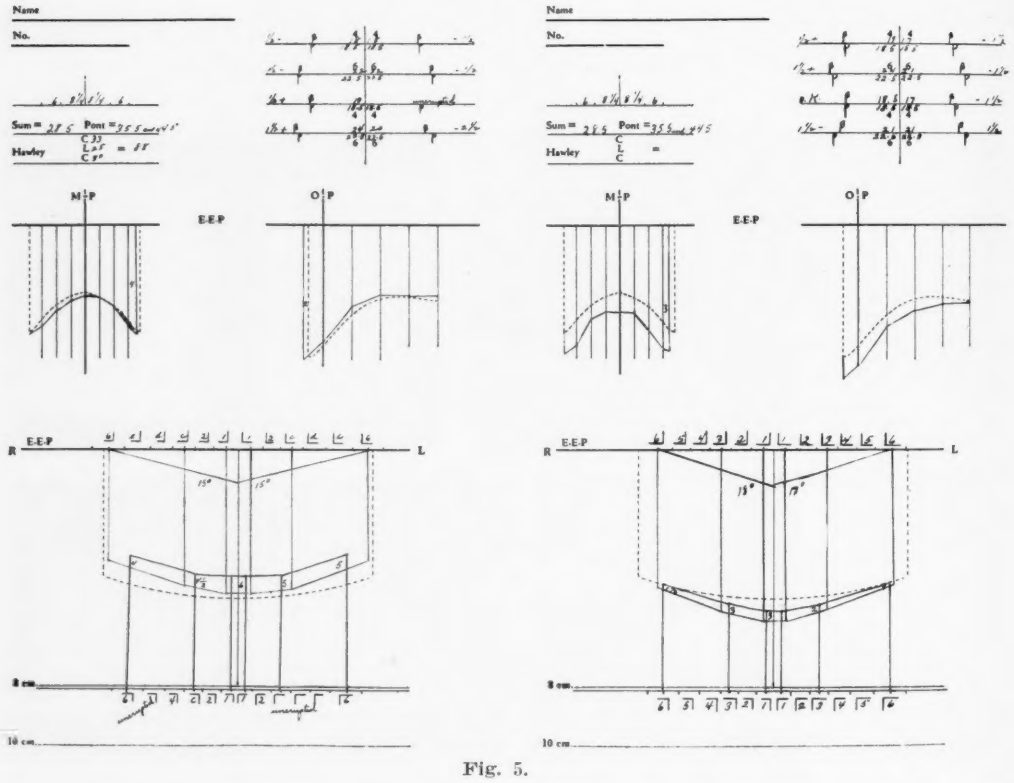


Fig. 5.

This case is from the practice of Dr. Ralph Waldron. His advice and assistance aided me materially throughout the entire case.

In order to conserve on the number of illustrations I have combined several of the cuts.

Figs. 1, 2, 3, and 4 present the case to be diagnosed and treated.

Fig. 5 shows the gnathostatic chart. The use of a map such as advocated by Simon gives the orthodontist a new method of interpretation.

The first part in the diagnosis to be discussed is the relation of the lateral halves of the denture to the median plane.

The maxilla is nearly correct.

The mandible presents a mild alveolar incisal lateral contraction plus an alveolar lateral dental distraction.

Second, relation to the orbital plane.

Examinations of Figs. 4 and 5 show a maxillary dental alveolar, incisal protraction; whereas Figs. 2, 3, and 6 indicate a total dental alveolar mandibular retraction.

Third, relation to the horizontal plane.

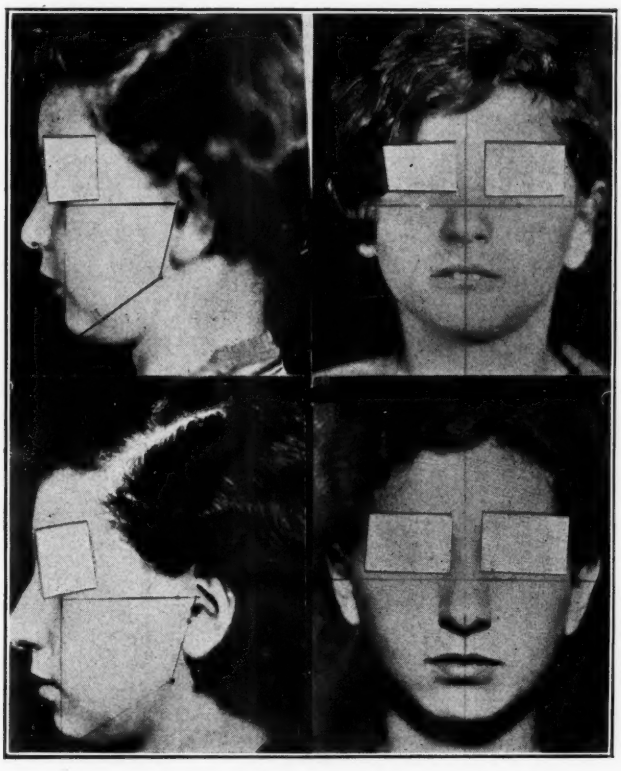


Fig. 6.

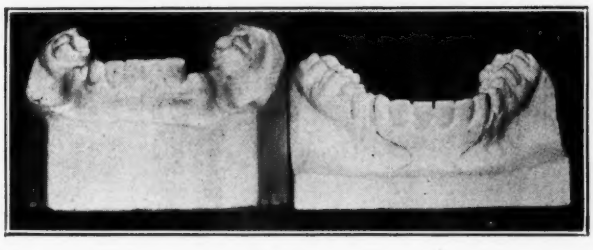


Fig. 7.

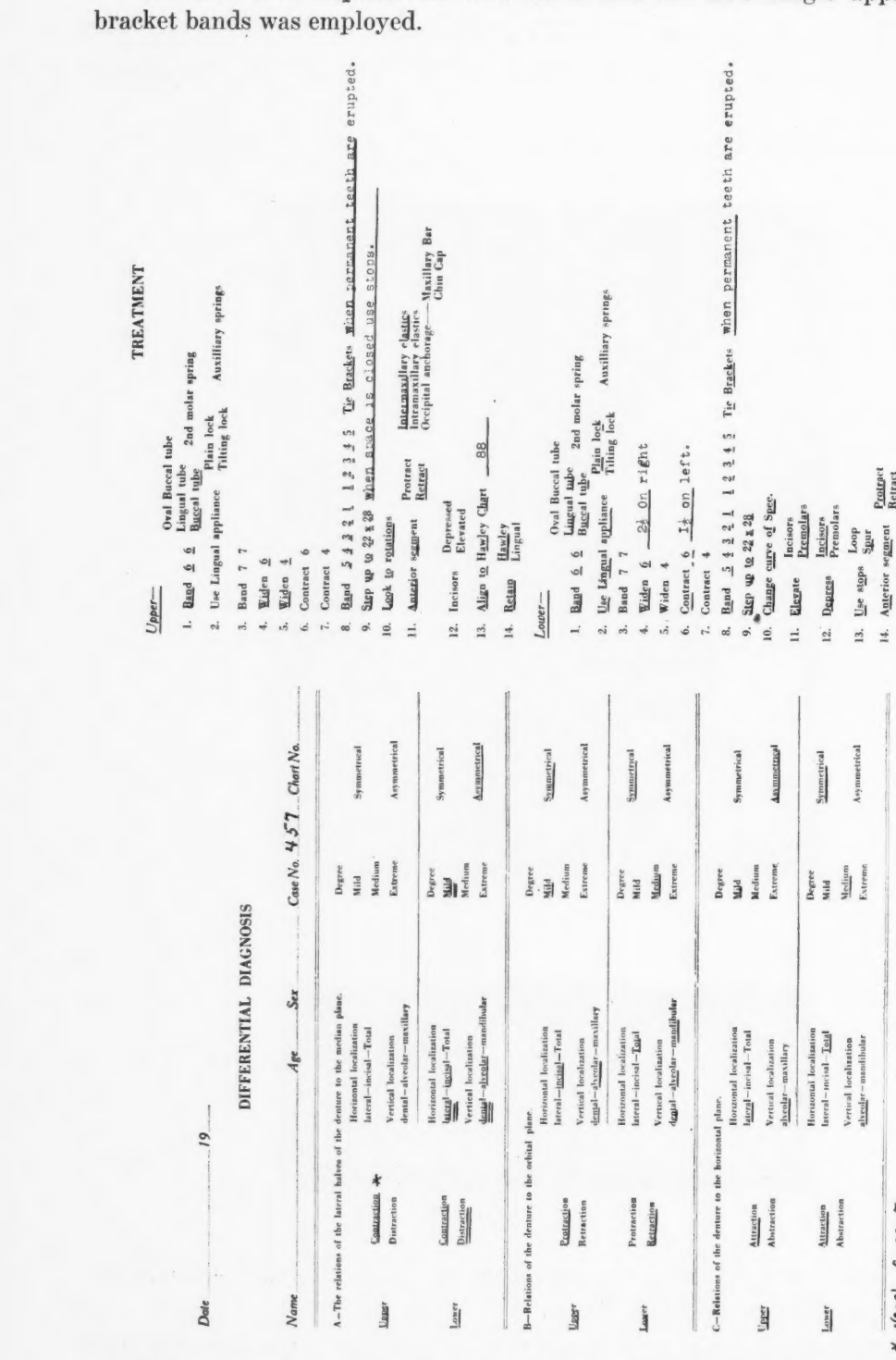
The maxilla is in a lateral alveolar attraction, with a total alveolar attraction of the mandible as shown in Fig. 5.

The actual treatment of this case is unusual because of the fact that three different type appliances were used.

1. The Angle ribbon arch was used for the maxillary arch, and a Mershon lingual arch was inserted in the mandibular arch.

2. All appliances were removed for some time.

3. Later new impressions were taken and the new Angle appliance with bracket bands was employed.



DIFFERENTIAL DIAGNOSIS

Date ..... 19....

Name ..... Age ..... Sex ..... Case No. 457 Chart No. .....

A—The relations of the denture to the median plane.

			Degree	
		Horizontal localization		
		lateral—incisal—Total	Mild	Symmetrical
	Contraction *		Medium	
Upper	Distraction	Vertical localization	Extreme	Asymmetrical
		dental—alveolar—maxillary		
		Horizontal localization	Degree	
	Contraction	lateral—incisal—Total	Mild	Symmetrical
Lower	Distraction	Vertical localization	Medium	
		dental—alveolar—mandibular	Extreme	Asymmetrical

B—Relations of the denture to the orbital plane.

			Degree	
		Horizontal localization		
		lateral—incisal—Total	Mild	Symmetrical
	Protraction		Medium	
Upper	Retraction	Vertical localization	Extreme	Asymmetrical
		dental—alveolar—maxillary		
		Horizontal localization	Degree	
	Protraction	lateral—incisal—Total	Mild	Symmetrical
Lower	Retraction		Medium	
		Vertical localization	Extreme	Asymmetrical
		dental—alveolar—mandibular		

C—Relations of the denture to the horizontal plane.

			Degree	
		Horizontal localization		
		lateral—incisal—Total	Mild	Symmetrical
	Attraction		Medium	
Upper	Abstraction	Vertical localization	Extreme	Asymmetrical
		alveolar—maxillary		
		Horizontal localization	Degree	
	Attraction	lateral—incisal—Total	Mild	Symmetrical
Lower	Abstraction		Medium	
		Vertical localization	Extreme	Asymmetrical
		alveolar—mandibular		

* Nearly Correct

Fig. 8.

TREATMENT

Upper—

1. Band 6 6 Oval Buccal tube / Lingual tube 2nd molar spring / Buccal tube
2. Use Lingual appliance Plain lock Tilting lock Auxiliary springs
3. Band 7 7
4. Widen 6
5. Widen 4
6. Contract 6
7. Contract 4
8. Band 5 4 3 2 1 1 2 3 4 5 Tie Brackets When permanent teeth are erupted.
9. Step up to 22 x 28 When brace is closed use stops.
10. Look to rotations
11. Anterior segment Protract / Retract — Intermaxillary elastics / Intramaxillary elastics / Occipital anchorage — Maxillary Bar / Chin Cap
12. Incisors Depressed / Elevated
13. Align to Hawley Chart ___88___
14. Retain Hawley / Lingual

Lower—

1. Band 6 6 Oval Buccal tube / Lingual tube 2nd molar spring / Buccal tube
2. Use Lingual appliance Plain lock / Tilting lock Auxiliary springs
3. Band 7 7
4. Widen 6 2½ on right
5. Widen 4
6. Contract 6 1½ on left.
7. Contract 4
8. Band 5 4 3 2 1 1 2 3 4 5 Tie Brackets when permanent teeth are erupted.
9. Step up to 22 x 28
10. Change curve of Spee.
11. Elevate Incisors / Premolars
12. Depress Incisors / Premolars
13. Use stops Loop / Spur
14. Anterior segment Protract / Retract
15. Look to rotations
16. Align to Hawley Chart
17. Retain Hawley / Lingual

Fig. 9.

Fig. 8 shows the chart used to indicate the differential diagnosis. Fig. 9 shows the treatment sheet which was followed.

I wish to call attention to some of the following observations, bearing in mind the fact that growth of the face has taken place; therefore the positions

of the orbitalia, tragus and gonion are not identical with respective points as shown in the original, but relatively they are the same.

A comparison of the two models will show the following:

1. Figs. 1, 2, and 3 show the space between the teeth, due, however, to the fact that appliances had just been removed.
2. In Fig. 4 the orbital plane passes through the canines.
3. Fig. 4, the 2 cm. mark from the orbital plane is correct.
4. In Fig. 5 the prostheon is relatively correct.
5. Fig. 5, the angulation has been changed from 15° to 18° and 17°.
6. In Fig. 5, the distance from maxillary molar to molar has been changed. The deciduous teeth were larger.
7. Same as mandible.
8. Fig. 7, the exaggerated curve of Spee has been corrected.
9. Figs. 1 to 5, the overbite has been corrected.
10. Fig. 5, the incisal area has been changed and lengthened, due to growth.
11. Fig. 5 shows the change in palate form.
12. Fig. 6 shows the change in face form improvement.

In conclusion, I wish to repeat that Simon gave to the orthodontic profession a better fiction, that of molar constancy. Even Angle changed his mind concerning the molar constancy, as shown in his article on "The Latest and Best in Orthodontic Mechanism," when he states, "more or less abnormal tipping . . . and often also a slight bodily drifting forward of their normal positions."

The Simon method enables one to measure and judge anomalies by comparing them with an average jaw, obtained and calculated by the result of intensive study, and charting of several hundred cases. This is the basis of a so-called ideal, which does not exist in reality; it is a fiction, but a real working fiction. In truth his method can be called a starting point for orthodontic diagnosis.

THE CRISIS IN ORTHODONTIA*

PART I

3. CRITICAL REVIEW OF THE PUBLICATIONS ON ORTHODONTIA BY B. GOTTLIEB, B. ORBAN, A. M. SCHWARZ AND J. A. MARSHALL†

ALBIN OPPENHEIM, VIENNA, AUSTRIA

(Continued from page 1076, November)

The formation of new bony spicules, arranged vertically to the long axis of the tooth (osteophytes) which I described and which was verified by Bodecker[6] (p. 905) occurs, according to Bodecker, quoting Gottlieb and Orban, only "when extreme pressure completely destroys the lamina dura"; such destructive forces may perhaps have their place in animal experiments but never in orthodontia. By no means are basic conclusions for modern orthodontic therapy permissible from such experiments.

The alveolar walls of monkeys and man, often not thicker than tissue paper, cannot be abused as can the solidly built alveolar walls of the dog, unless one is willing to run the risk of having the bone completely destroyed.

The jaw bone of dogs, on account of the hinge-joint (ginglymus) which does not permit any lateral movement, is built up entirely under the influence of the hammer-anvil action. Each artificial force in a lateral direction, therefore, means an entirely new, hitherto unknown stimulus to the jaw bone of the dog. The structure of jaw bone of man and monkey, on the contrary, is adjusted to the influence of lateral grinding movements. Therefore, the complete rebuilding of bone that takes place as the result of a tilting force is not likely to bring about identical results in man, monkey, and dog.

In verbal communication on this question, Prof. Dr. J. Tandler, Director of the First Anatomical Institute of the University of Vienna, explained his viewpoint in the following manner: "The development of the alveolar juga in the area of the anterior teeth is dependent not only upon the relation between the size of the roots and the labiolingual diameter of the alveolar process but also upon the functional conditions. The labial wall of the alveolar jugum is the thinnest part of the alveolus. It is a common observation that this thin wall can be reduced to such an extent that the apex or a larger or smaller part of the apical root portion is covered only by the periosteum. Comparative anatomy has taught that well-developed alveolar juga are found in anthropoid apes and in man; in the carnivora they are

*From the Department of Orthodontia of the Dental Institute of the University of Vienna.

†Translated in abbreviated form from *Ztschr. f. Stomat.*, supplement to No. 22, November, 1933, published by Urban & Schwarzenberg, Vienna and Berlin.

usually not present, and the labial wall of the alveolar process is formed by a heavy wall of bone of uniform thickness, so that there are no or nearly no alveolar juga. This latter condition is found in the various types of dogs.

"The transmission of functional stresses to the alveolar wall obviously depends upon the direction of force, which is exerted upon the crown, and indirectly upon the root. In the normal human dentition the incisor teeth are subjected to a nearly vertical stress. As a result, in the normal dentition no or very little pressure is exerted against the labial alveolar wall. There is no leverage against this wall. For reasons of tissue economy this labial alveolar wall is very thin, and the projection of the juga in the incisor region is due to this thinning. A similar but not so pronounced development of the alveolar juga is observed in the posterior teeth of the human upper jaw."

These gross anatomical differences in the jaws of dogs, monkeys, and man make it obvious that the results obtained by experiments on dogs and monkeys must be quite different.

One is, therefore, much more justified in drawing conclusions for man from experiments on monkeys than from those on dogs, for the jaw bone of the former is in many ways (especially structurally) more similarly built.

W. Gubler[7] states: "The jaw bone of a dog is much more compact than that of man. The cementum of the dog toward the apex is usually thickened to a quite considerable degree. Furthermore we do not find in a dog such a sharply defined bone canal with blood vessels and nerves as in man. The apex is often separated from the marrow spaces of the bone only by a very thin layer of spongy bone, or it projects into wide marrow spaces."

This difference in the anchorage of the apex in a dog, contrary to the conditions in man, may be responsible for the fact that nobody, including Gottlieb and Orban, has so far been able to produce a genuine root resorption in a dog.

Wannenmacher[8] states: "The findings of Gottlieb and Orban, upon which are based the biologic effect theory of Schwarz, cannot be applied without restriction to human conditions."

Orban[9] wrote (p. 853): "The alveolar bone of a dog is much more compact than that of man. . . . The cementum is much thinner so that it is barely visible at the cemento-enamel junction. . . . The differences in the normal anatomical conditions of the paradentium of man and dog are so great that they do not permit positive reciprocal conclusions, as to the reaction of these tissues, under either normal or pathologic conditions."

Upon what new findings is based the change in the viewpoint of Orban who nine years after this statement found himself justified in transferring the results of his experiments on dogs to human conditions without restriction?

The doubts expressed here against the applicability of experimental dog material also apply of necessity to my own experiments on dogs; but in my experiments at least the arrangement of the regulating appliance and the intensity of the applied force corresponded as much as possible to the conditions in man.

I cannot agree with the statement of Korkhaus[10] (p. 94) that the findings of Gottlieb and Orban in their experiments with excessive occlusal forces constitute an enlargement "by interesting and important details" of my findings, for the experiments of these authors and mine have nothing in common. Moreover Korkhaus does not in any way explain what "these interesting and important details" are which add something to my basic findings and to their practical application.

In the critical review[6] of Gottlieb and Orban's work, Bodecker says (p. 911): "A thorough comprehension of the changes that take place in the bone as a result of a varying degree of pressure appears to be important in successful orthodontic treatment. Clinical observations of orthodontists that a slight, constant pressure should be used in bringing the teeth to their normal occlusion are now scientifically established by Gottlieb and Orban, who show the reasons for it."

Just as the first sentence of this quotation is entirely correct, so the second sentence is entirely incorrect. Had Bodecker read my first publication, "Tissue Changes, Particularly of the Bone, Incident to Tooth Movement" in the *American Orthodontist* (October, 1911, and January, 1912) or the supplement in the INTERNATIONAL JOURNAL OF ORTHODONTIA AND DENTISTRY FOR CHILDREN (May, 1930, p. 535) or other like books and publications (McCoy, Hellman), all of which stress the postulate that only the slightest forces can be considered in practical orthodontia, then he could not have written the second sentence. It was not Gottlieb and Orban who "scientifically established" this clinical observation. In my work (*American Orthodontist,* 1912, p. 124) I wrote: "This characteristic transformation results only upon the application of very slight, physiological-like influences"; on page 129, "we do not reach our goal by fast movement or by application of powerful forces, on the contrary . . . ," and on page 130, "the slower the movement is accomplished, the slighter will be the looseness of the tooth. The firmness of the tooth during the process of movement will then be our criterion for the correctly measured force," and postulated on page 130, "Hence the demand, in encountering great resistance, not to increase the forces but to prolong the time of their influence." After having said this, I said: "These contentions coincide completely with the observations and the clinical experiences." All that Bodecker attributes to Gottlieb and Orban, I stated concisely twenty-two years ago.

Bodecker will not be able to show *one* convincing picture out of the whole book of Gottlieb and Orban which would indicate "that these authors have scientifically ascertained the proof for the clinical observation that slight constant pressure in the movements of teeth is to be used." And, on the other hand, my postulate that henceforth only gentle forces are permissible was not the result of clinical observation, but, on the contrary, the result of my experiments which were responsible for the change in clinical procedure and for the discontinuation of the strong forces heretofore used.

But this opinion of Bodecker on the work of Gottlieb and Orban is not surprising. Bodecker is an excellent histologist and histopathologist, but so

far as I know, he does not practice orthodontia any more than do Gottlieb and Orban. Therefore, he is unable to evaluate the situation properly. From an orthodontic point of view he can neither have the correct conception nor pass judgment, for he is not familiar with the literature on the subject—the first requisite for the right to criticize.

Contrary to the statements of Bodecker, the experiments with excessive forces on dogs by Gottlieb and Orban have demonstrated only the changes produced by strongest intermittent forces and have proved the fact that even the severest damages and necrosis may eventually be completely restored, including the restoration of a periodontal membrane of normal width and of normal functional structure.

For the study of pyorrhea these experiments with excessive forces have ascertained the fact (and thus cut off any further discussion) that "excessive occlusal stress cannot cause this disease, not even a simple gingivitis," and furthermore that "excessive occlusal stress alone is of only secondary significance as an etiologic factor in the loosening of teeth."

For orthodontia the experiments of Gottlieb and Orban with excessive forces have ascertained only one fact of far-reaching importance, although this has not been pointed out by the authors: *Even the strongest intermittent forces are not able to produce genuine root resorption.*

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(To be continued)

THE EVOLUTION OF THE ORTHODONTIC APPLIANCE FROM THE SERIES OF RECONSTRUCTED SPECIMENS

BERNHARD WOLF WEINBERGER, D.D.S., NEW YORK, N. Y.

IT IS one thing to visualize the type of orthodontic appliances used throughout the ages, as shown in our dental literature, and quite another story when one actually sees them.

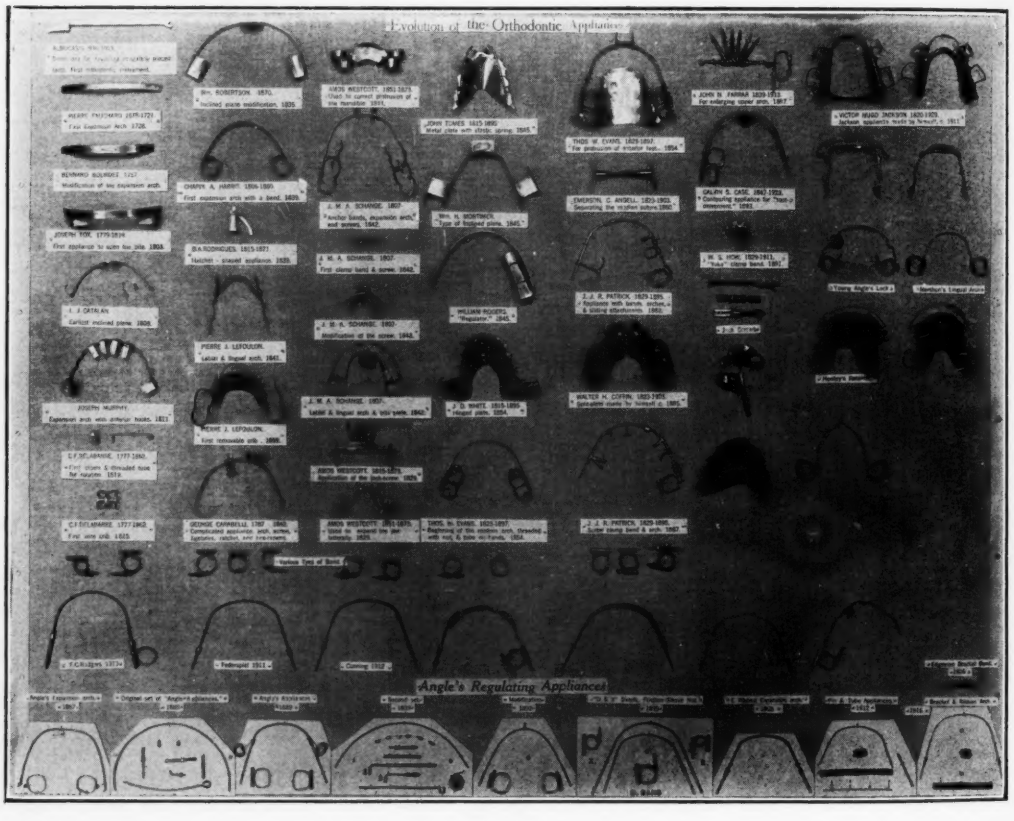

Fig. 1.

The orthodontia band is but the outgrowth of the crown and bridge work of the ancients. The principle involved is exactly the same. One can see how the Phoenicians, Etruscans, Greeks and Romans handled their prosthesis. Our modern cast gold inlays and overlays do not differ from the idea as practiced in 1000 B.C.; the disappearing wax model was used in both cases, with the exception of the present-day high pressure vacuum and force.

These replicas were made not only to give an idea of the actual specimens now found in the various museums, but it is my opinion that no one is in a

Presented at a meeting of the Eastern Association of Graduates of the Angle School of Orthodontists.

position to teach or speak with some definite authority without first having experienced the actual work. One thus learns just what technic was used and the difficulties involved.

I do not desire to go into the details of this, but it convinces me that during this period of our history, those who wrote our early textbooks never actually applied themselves to the work. Therefore there must have been specialists even in those days—those who applied themselves to writing and the clinical side of dentistry, and others who were master technicians.

Among the pieces reconstructed are the following:

	A.D.	
Albucasis:	1000.	Small axe.
Fauchard:	1728.	First expansion arch with holes punched to permit it to be tied to molar teeth.
Bourdet:	1757.	Holes added throughout the whole expansion arch.
Hunter:	1728.	"Plate" over molar teeth.
Fox:	1803.	Expansion arch extended to molars, with ivory blocks.
Catalan:	1808.	Inclined plane.
Murphy:	1811.	Bow of spring of gold wire, with flat hooks upon incisors.
Delabarre:	1815.	First crown and threaded tube for rotation. First wire crib.
Robertson, Wm.:	1835.	Inclined plane as part of expansion arch.
Rodrigues:	1839.	Individual inclined plane.
Lefoulon:	1841.	Labial and lingual arch.
Lefoulon:		Removable crib.
Schange:	1842.	"Crib" of Schange.
Schange:		Another type with attached labial arch and use of screw.
Schange:		Modification of screw.
Schange:		First application of clamp band.
Schange:		Low metal "bar" (arch) with lingual inclined plane (bite plate).
Carabelli:	1842.	Complicated appliances showing use of the screw, ratchet and ligatures.
Desirabode:	1843.	Labial and lingual arch combination.
Westcott:	1844.	"Correct protrusion of under jaw."
Westcott:		Method to expand jaw laterally.
Westcott:		Application of the jackscrew.
Mortimer:	1845.	Inclined plane.
Tomes, J.:	1847.	Metal plate with elastic springs.
Rogers, Wm.:	1845.	"Regulator" with ratchet and spring.
White, J. D.:	1850.	Spiral spring and arch and bands.
White, J. D.:		Hinged plate with spiral springs.
Evans, Thos.:	1854.	"Clamp" bands, arch, anterior hooks and springs.
Evans, Thos.:		Threaded arch, nut, tube and clamp band. Beginning of the modern expansion arch.

	A.D.	
Garnes:	1858.	Showing use of screw.
Angell, E. C.:	1860.	Separating the suture.
Coffin, W. H.:		Original Coffin Plate made by Walter Harris Coffin about 1882.
Patrick, J. J. R.:	1882.	Screw clamp band and arch.
How:	1887.	"Yoke" clamp band and various attachments.
Angle:	1887.	Angle's system of regulating appliances.
Angle:	1887.	First expansion arch.
Angle:	1888.	Original set of Angle appliances.
Angle:	1889.	Appliance as used by Angle and second set.
Angle:	1892.	Modification of 1889 appliance.
Angle:	1899.	"D" band, expansion arch with friction sleeve nut. X band.
Angle:	1903.	Ribbed E arch.
Angle:	1912.	Pin and tube appliance.
Angle:	1916.	Ribbon arch and brackets.
Angle:	1926.	Edgewise arch.
Jackson, V. H.:		Jackson's original removable appliances made by him about 1912.
Farrar:	1882.	Jack screw to enlarge arch. Case's (1892) root movement.

MALOCCLUSION ACCENTUATING A FACIAL DEFORMITY*

ROBERT CUTLER, M.R.C.S., L.R.C.P., L.D.S., R.C.S., LONDON, ENGLAND

THIS is a very simple case from the Children's Department of Guy's Dental School. It shows how an original malformation of the jaws may be exaggerated in its outward facial appearance by the manner of eruption and articulation of the corresponding teeth, so giving rise to a general facial ensemble that, in a girl, cannot be regarded as other than serious.

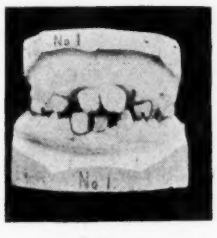

Fig. 1.

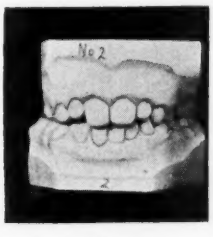

Fig. 2.

Fig. 3.

Fig. 4.

In these days of beauty specialists so much can be done that the plain girl has now equal chances with girls more happily endowed, and in such a connection the help of the orthodontist may prove invaluable.

In talking of facial deformities, we are, I think, always inclined to visualize profile abnormalities, that is, defects in the anteroposterior jaw relationships, but there is also a quite distinct group of lateral jaw abnormalities, with its corresponding anterior facial defect, which call for comment and treatment.

The models of the case under review show a relatively simple Class 1 case with narrowed maxilla and slightly asymmetrical mandible, neither great in themselves, but intensified out of all proportion by the subsequent eruption of the teeth, and by the false biting posture that has naturally ensued. (Fig. 1.)

*Transactions of British Society for the Study of Orthodontics, 1933.

Treatment of the case was by means of removable expansion appliances in the maxilla only, these appliances being characterized by a left lateral incline designed to keep the left side of the mouth in correct occlusion while the right side in lingual occlusion is actively stimulated.

I know certain forms of fixed appliance are designed to bring about asymmetrical expansion, but the removable expansion appliance with lateral incline always impresses me with being the most simple and rational method provided enough of the deciduous teeth remain.

The second pair of models shows how the case is resolving on normal lines, calling for little more than a further period of supervision and general expansion. (Fig. 2.)

The photographs (Figs. 3 and 4) show the improvement in the dental aspect, although the residual jaw abnormality is still apparent. This case is one of many where simple mechanical interference at the right time may prove of inestimable benefit to the appearance, function, and dental health, and after all, what factors constitute the welfare of our patient more than these?

DISCUSSION

The *President* suggested that one of the possible causes of such a malocclusion as Mr. Cutler had described, operated chiefly in the maxilla. He had seen it in a number of cases in which a child had been in the habit of resting its face on its hand while studying or reading. If the deformity were on the left side, the orthodontist was on fairly safe ground in inquiring for this cause. It was of no use putting in appliances without removing the cause. He had seen appliances push a tooth out on the opposite side without improving the occlusion on the affected side.

Mr. G. Northcroft suggested that the condition occurred in many chlidren who were too young to lean on their hands in the way the President described. He considered that the abnormality was often a developmental one and not an acquired one at all, even by such early habits as "pillowing." He inquired the age of the patient.

The *President* related a case in which the teeth had been quite normal and the malocclusion had appeared on the left side at eleven or twelve years of age. It had been traced entirely to the habit he had mentioned.

Mr. Ainsworth said that the appliance which Mr. Cutler had described was interesting to him as a modification of the Badcock plate. He asked why it was necessary to make the crib on the right-hand side loose, when the tooth was moving out of its place.

Mr. H. Chapman praised Mr. Cutler's apparatus as very ingenious and successful. Nevertheless, he would not have thought that the anchorage which Mr. Cutler could obtain from the mandibular teeth would be sufficient to bring about the desired results. The flange (on the plate), which came down to engage the mandibular molars, could only be operative when the child was masticating; if the plate was worn for twenty-four hours and mastication proceeded for one hour, it did not seem possible the result could be due to this part of the apparatus.

Mr. Cutler, in reply, said that some cause must exist of the nature which the President had described. He had not made inquiries, being chiefly concerned with the mechanical possibilities of the device. The age of the patient had been eight and one-half years. The object referred to by Mr. Ainsworth was not a crib, but merely a wire that went around the whole of the outside, and was left free. Mr. H. Chapman had, Mr. Cutler said, raised a very good point. After all, orthodontists used inclines, particularly an anterior incline, for align-

ing irregularities of the mandibular front teeth in cases where the maxilla was a little narrowed in the intercanine space with some degree of close bite. The result was that the teeth straightened up, and therefore a definite impression must be made by means of an incline only. The incline was sometimes used in correcting a postural abnormality and getting a forward bite, so a certain dynamic action was to be obtained from it. It was carried the whole way along, and if the deciduous and first permanent molars and lateral incisors were all present and an incline were fitted along the whole side, it was probably sufficient. Mr. Chapman was correct in saying that the appliance was only functional during mastication, talking and laughing. Mr. Cutler said that he had always recommended emphatically that these plates should be worn at mealtimes, and in stating that if they were not they would not act. The idea was not a new one, but had been shown him by a very distinguished practitioner, who had treated several cases with a lateral incline. Colleagues had told him, speaking of cases where one side was wrong and the other right, that it was sufficient simply to expand, relying on the articulation of cusps on the right to give sufficient extra anchorage. When, however, he had done this, he had always found that the wrong side stayed wrong and the right side became wrong.

FURTHER CASES ILLUSTRATING THE ILL-EFFECTS TO THE MAXILLARY ARCH OF THE LOSS OF MANDIBULAR TEETH*

HAROLD CHAPMAN, L.D.S., LONDON, ENGLAND

CASE 1.—Female, aged nineteen years, Class I malocclusion.

At the age of sixteen and one-half years, | 1 was extracted because it was badly rotated: from the history, probably one of the approximal surfaces presented labially. Since the removal of this tooth the patient thinks the maxillary laterals have become more unsightly, particularly the left one, which rests on the lower lip. It would seem that this case originally was an example of some contraction of both arches, represented in the mandibular by severe rotation of one incisor, and in the maxillary arch by labial occlusion

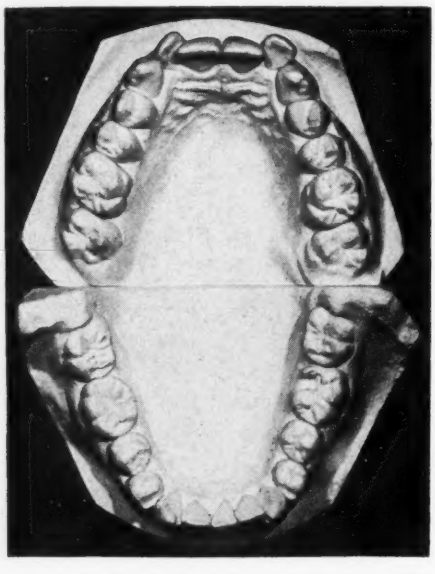

Fig. 1.

of the lateral incisors, but not sufficient to direct attention to it. In all probability the loss of the mandibular tooth has allowed the mandibular arch to become smaller (and the alignment to remain good); and when it contracted, the maxillary arch contracted also, but as there was no loss of a tooth, a crowding—in this particular case an increased crowding—is to be expected (particularly if there is any facility for this to occur, e.g., incorrect approximal contact as in this case between 2 1 | and | 1 2), and is shown by the increased labioclination of 2 | 2, now sufficient to be unsightly (Fig. 1).

It would be interesting to know whether there would have been any collapse of the maxillary arch had this arch been normal and the approximal contact of all the teeth correct. It would also be interesting to know whether a more satisfactory result would have been obtained had a maxillary lateral incisor been removed when a mandibular central incisor was taken out, or even

*Transactions of British Society for the Study of Orthodontics, 1933.

a maxillary central incisor, as was done in a case shown by Mr. A. L. Packham in 1926.* The general condition of the mouth was excellent.

CASE 2.—Male, aged fourteen years, Class II, division 1, an almost typical example.

The arch is good: the general condition of the mouth is good, except that $\overline{6 \mid 6}$ have lost their crowns entirely through caries and only the roots remain, with consequent reduction in the space occupied by the crowns. A typical feature of the case is that $\underline{1 \mid}$ is considerably labial to the alignment of the remaining maxillary teeth (Fig. 2); the arrangment of the other maxillary anterior teeth is typical of this malocclusion. The mother reports that the position of the maxillary central incisor is getting worse. This would only seem to be possible if the mandibular arch is becoming smaller, which it may

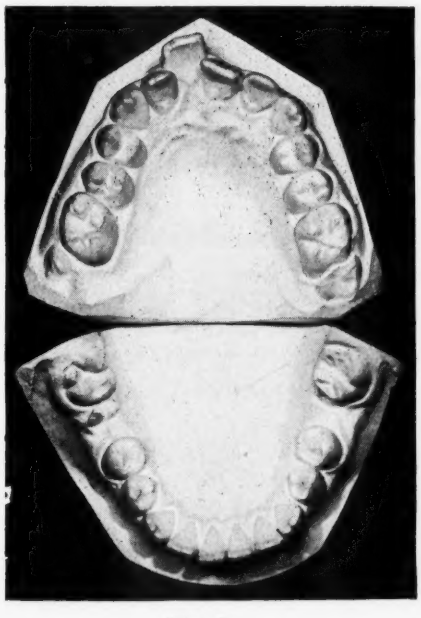

Fig. 2.

quite well be doing as a result of the loss of the crowns of $\overline{6 \mid 6}$: the roots of these teeth were removed shortly after the impressions were taken.

DISCUSSION

The *President* asked Mr. Chapman whether he was doing any treatment for that case, which was very similar to the case of the doctor's daughter which he himself had shown. He would take the maxillary first or second premolar to compensate to some extent for the loss of the two mandibular molars, and to restore the balance which was lacking. If he did this he would get an easy result in the next six months.

Mr. Packham thanked Mr. Chapman for showing, by his communication, in a yet clearer light the difficulties which attended the practice of orthodontics by the extraction of teeth. It had always seemed to the speaker since he had worked on the subject that the practice of orthodontics was extremely difficult in any case; its practice by the extraction of teeth was even more difficult. It was very hard to know what was going to happen after the extractions had been carried out. Even if Mr. Chapman had emphasized that note alone, the society would have learned a great deal from his communication.

*Packham, A. L.: "A Case Showing Tooth Movement." Trans. British Society for the Study of Orthodontics, 1926, page 40.

DEPARTMENT OF
DENTISTRY FOR CHILDREN

THE CHEMICAL TREATMENT OF SEVERAL OF THE DISEASES OF THE ORAL TISSUES WITH SPECIAL EMPHASIS UPON TEETH WITH NONVITAL PULPS

STUART KABNICK, D.D.S., F.A.I.C., PHILADELPHIA, PA.

WITHIN the last two decades, the tooth with a nonvital pulp has been the subject of more discussion than any other phase of dental work. This great amount of attention both by the profession and by the laity was caused by the demonstration of the relation of the septic tooth to the rheumatic joint about twenty years ago. This discovery was followed by the hysterical use, in root therapy, of every drug of any germicidal value, and all this time the fine teachings of the dental histologists were lost sight of. Overemphasis upon the cleansing and the filling of the main pulp canal without consideration of the other tooth structures has been the cause of the long chain of failures in this work.

Every survey made of teeth with nonvital pulps that ended with the pointing of a finger of scorn at this part of dentistry, has failed to bring out the fact that little or no attempt was made to disinfect the entire tooth structures and their investing tissues that would permit of bacterial metabolism and respiration. Dentin does have a matrix, tubuli, sheaths of Neumann, interglobular spaces, granular layer, Schreger's lines and the contour lines of Owen. Since the days of Howard Mummery (1892) it has been understood that dentin is not a homogeneous mass or substance. The microscopic study of dentin shows the numerous interpenetrating fibril-containing lamellae. (Fig. 1.) It is these spaces that we must disinfect, as well as the cementum and the contiguous osseous tissues, if we wish to hope for success in root therapy. Microorganisms will follow the courses of the organic fibers or tissues in the dentin via the tubuli (Fig. 2*A*), in the cementum via the fibers of Scharpey, as well as the pulp in the main canal (Fig. 2*B*).

Surrounding the root is the periodontal membrane—here we find many white connective tissue fibers, blood vessels, and nerves—and I am of the opinion that there are also present here many tubular glands, all of which supply the necessary material for bacterial multiplication. In direct contact with the periodontal membranes are the laminae durae. These are roentgenographically visible thin sheets of compact bone. This is nature's last line of defense, and beyond lie the large open spaces in the bone which are filled with quantities of

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red medullary tissue. It is here that great havoc is wrought by the acids resulting from the breaking down of the above mentioned organic materials.

A highly specialized organ like the dental pulp has little or no defensive mechanism against complete destruction once it is invaded by bacteria. Trauma in the form of either a blow or severe thermal or electric shock will start the degenerative processes in a normal pulp in the absence of dental caries. Enamel and dentin can be replaced successfully with the many materials at the disposal of the dental operator. However, there is little hope of repair of the dental pulp once disease has begun in this tissue, and every particle of pulp tissue, whether it be the body in the main canal or a minute branch of a fibril in one of

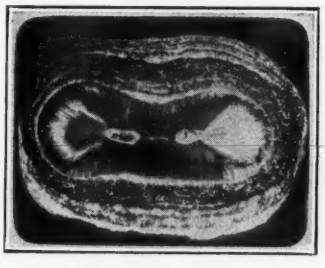
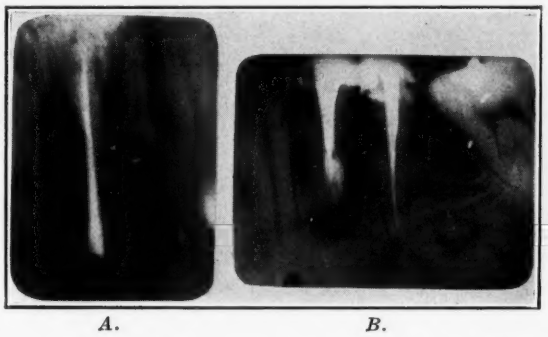


Fig. 1.—Cross-section of maxillary first premolar, showing irregularly shaped main canals. Leading from these are many large dentinal tubuli, interglobular spaces, and the granular layer. The cementum (crusta petrosa) contains many layers broken here and there by myriads of lacunae and canaliculi, which radiate from the interglobular spaces and communicate with the lacunae. All these spaces and canals invariably contain organic tissue and must be disinfected as well as the main canals.



A. *B.*

Fig. 2.—*A* (Mrs. P.), demineralized dentin, completely disinfected. Large quantities of the barium are in evidence in the apical dentin as well as in the main canal. *B* (Mr. S.), disinfection of cementum and lamina dura as well as of the main canal.

the branches of a dentinal tubule, must be rendered permanently aseptic by disinfection. (See Fig. 1.) It is not difficult to believe that when the blood system of the pulp is deranged, it is deprived of its trophic functions with regard to the tissues around it. The degenerated pulp will transmit its lowered vitality to the dentin and the periodontal membrane. The supply of nourishment to the dentin is stopped, and there may follow many changes in this tissue, i.e., adventitious dentin. The fibroid degeneration of the pulp is shared by the periodontal membrane.

My preceptor, Dr. Arthur Hopewell-Smith, thought that suppurative foci could occur in any part of the periodontal membrane and called the larger ones

the alveolar abscesses. The elimination of a primary focus of this type will stop the flow of toxalbumins, enzymes, and other end-products of putrefaction into the blood or lymph streams.

Much of the diseased osseous tissue is caused by the destructive action of the minute quantities of the weak acids (acetic, formic, lactic, hippuric, oxalic, and butyric) formed by bacterial metabolism and respiration that takes place in the lacunae and canaliculi present in all the above mentioned tissues. The essential alkalinity of bone (normally maintained at pH 7.4, other research workers have found this to be as high as pH 8.2) is destroyed and finally becomes acidic. (Necrotic bone shows a pH of 4.5 to pH 5.5.)

Let us now consider a method of approaching this problem chemically, bearing in mind the salient histologic aspects of the structures involved. The chemicals to be used, in order that they may fit into our daily practice, must be

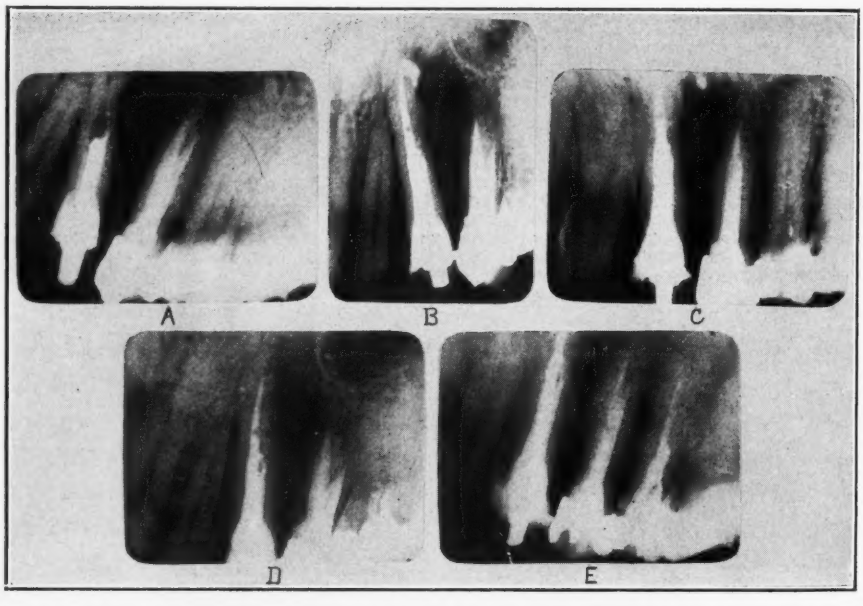


Fig. 3.—(Miss T.) This case presents nearly all the obstacles that one is liable to encounter in the practice of root therapy. Three consecutive teeth with nonvital pulps, all of long standing. The canine has a pathologic perforation, a pin or dowel. The apex is completely denuded. *D*, The pathosis involves the periapical tissues as well as the alveolar tissues contiguous with the perforation. *D* also shows the island of new bone forming in the center of the site of the old necrotic area. *E* shows the case at the end of eight years.

capable of permanently disinfecting all the tissues involved by destroying the pathogenic organisms (both the aerobes and the anaerobes and their spores) present.

It is wise to leave the already inflamed gingival tissues at ease and not to traumatize them further with ligatures, clamps, or even the tight rubber dam. Opacity to the roentgen ray is a characteristic that the medicaments used in the treatment and the filling of the roots of teeth with nonvital pulps must have, for we would be able to observe the progress of the chemotaxis or permeation in the canals without using any foreign wires or instruments that usually are plunged into the periapical spaces before the patient responds. After all there is no tactile sense in a tooth with a nonvital pulp. The discomfort produced is

caused by the application of force to the periapical tissues, either directly with the instrument used or applied through the contained liquid.

It is desirable to obtain a good result in disinfection of the septic tooth structures simultaneously with the formation of the main canal filling, in a minimum number of treatments.

The medicaments or chemicals used in the disinfection of the root structures as well as in the final root filling must be alkaline. If the root filling is a nonconductor of both heat and electricity, it will have little or no effect upon the normal biochemical reactions that are taking place in the periapical tissues.

A slight degree of expansion is a very desirable characteristic of the canal filling, as this will supplement an inadequate attempt to fill the canal completely.

The material must be slow in setting to permit ease of manipulation.

Its powers of disinfection should not be lost during the life of the root filling, and yet should remain bland in activity, so as not to cause any destructive influence upon the tooth germs and the contiguous tissues.

Our filling should permit us as many attempts to rehabilitate the tooth as we desire and especially after the removal of gutta-percha or amalgam canal

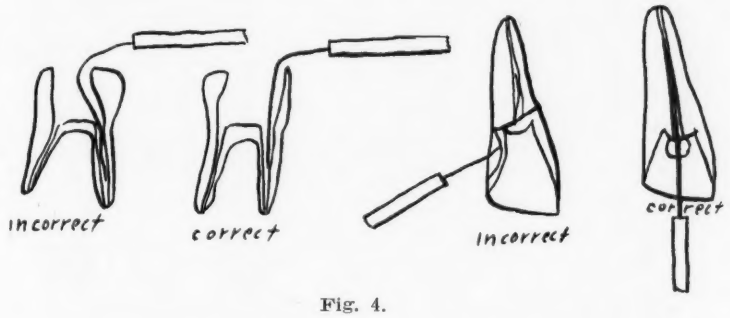


Fig. 4.

fillings. The tooth exhibiting a fistula or perforation should respond as well as a simple case immediately following devitalization. (Fig. 3.)

It is scientifically correct to leave the teeth under treatment open to insure drainage all during this period; therefore our chemicals must continue to destroy the bacteria and their spores in the presence of saliva. This allows for greater elasticity of time between visits of the patient to the dental office.

The chemicals of the root filling should combine with the tooth structures themselves, thereby becoming an integral part of the tooth itself.

It is good practice to make a roentgenographic study of the tooth or teeth and of the adjacent tissues under consideration. Determine the type of case at hand and plan a definite course of treatment. The first operative procedure is to take the tooth out of occlusion by using any suitable large stone. If a pericementitis is present, stone the occluding tooth or teeth and continue this process all during the period of treatment, since trauma will cause a recurrence of pain if the teeth should come back into occlusion while the tooth is under treatment. Enlarge the pulp chamber enough to gain easy access to the orifices of all the canals, without bending the working end of the root canal instruments. (Fig. 4.) Insert a root reamer in the orifice of each canal present in the tooth as shown in Fig. 5. Pack oxyphosphate of zinc cement in and about the instru-

ments until the contours of the tooth are restored and allow it to set well before removing the reamers. It might be a good idea to oil the instruments to prevent sticking of the cement, although I have not encountered this difficulty. When the cement has set, it is a simple matter to rotate the instruments out of the cement by turning them counterclockwise. This step prevents discoloration of the enamel (unless it is greatly decalcified) and permits the operator to make each subsequent treatment in a few minutes. From this point on, it is not necessary to remove any temporary fillings before starting treatment or to place one when the operation is completed, and continual drainage is possible. The small supplementary canal through the cement will permit the egress of any gases (carbon dioxide, hydrogen sulphide, sulphur dioxide, ethane and free hydrogen) that may form, as well as the unhindered flow of pus if there is any present, yet it is so small as not to permit blocking by food. The canal is easily located on the surface of the tooth (Figs. 6 and 7), and eyestrain is reduced almost to zero. There is no hunting for the orifices of the canals, and

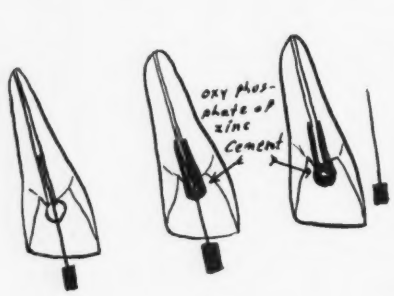


Fig. 5.

Fig. 6.

Fig. 7.

treatment time can be arranged as the operator wishes. He may spend three or four minutes or he may hold the patient an hour.

I have grouped my chemicals into two liquids and one powder. For disinfectants I have chosen the two elements which have proved the most efficacious —iodine ranks highest as a germicide, silver second. The necessary alkalinity is produced by the salts of the alkaline metals, i.e., calcium, magnesium, and potassium. Barium is used because of its opacity to the roentgen ray and its insolubility. Combined, this group will disinfect all instruments that are utilized in this work every time they are plunged into the paste that R.C.F. forms.

For the sake of convenience the first group has been called R. solution, the second C. solution, and the third F. powder (R.C.F. signifying root canal filling and the order in which they are used).

Continuing the discussion of the treatment mentioned above, we now have the tooth out of occlusion and lined with cement. The next step is to disinfect the remaining débris in the canal. Dry the canal with paper points, being careful not to pump the material beyond the apex. If any of the treated débris is forced into the periapical spaces, it will set up a chemical inflammation which can be reduced in a day or so; while on the other hand, the presence of the septic

canal contents will produce an inflammation that will be difficult to handle.* Using the specially designed glass pipettes, place a minim of R. solution in each canal and carefully force this liquid into the canal content with a fine smooth broach. Allow this to remain a few minutes and follow with a drop of C. solution. Then with a fine barbed broach remove as much of this chemically treated débris as possible without going through the apex or forcing any material through any of the apical openings. Always exert great care when working in the apical quarter of the root, as more damage is done by trauma of instrumentation than any other error except the sealing of the tooth between treatments.

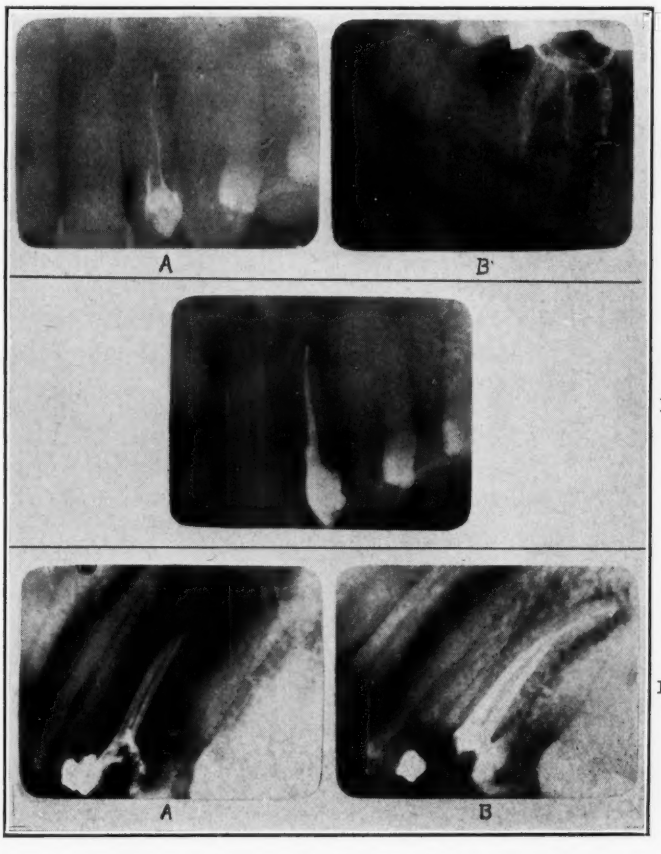


Fig. 8.

Fig. 9.

Fig. 10.

Fig. 8.—*A*, Second treatment. Case ready for completion of root filling. *B*, Molar ready for root filling.

Fig. 9.—Case shown in Fig. 8*A* completed.

Fig. 10.—*A*, Root only partially filled. *B*, Same case completed.

When the barbed broach is withdrawn with only a few small pieces of fibers, discontinue this operation and dry the canal. Do not use any other chemicals such as alcohol or chloroform. Never mix technics unless you are doing research work. Place two or three drops of R. solution on a clean slab and mix into this fluid several pinches of F. powder. (Use your college pliers.) A noncorroding metal spatula or one made of glass should be used for spatulation. With the canal fairly dry, pick some of this R. and F. paste on a fine

*I use an extraoral ice water spray.

smooth broach and force it deep into the canal. Repeat several times, using the precaution of not applying too much force. Wipe away any excess that may be expressed from the orifice of the canal in the cement and check the result with a roentgenogram. Dismiss the patient for three days to a week. (If it is necessary to complete the case rapidly, the second treatment can be placed in twenty-four hours.)

On the second visit, the roentgenogram of the previous treatment should be studied. If there is evidence that the R.C.F. has been placed beyond the first half of the canal an effort should be made at this sitting to approach the apex. Place cotton rolls or use any method of preserving dryness that you

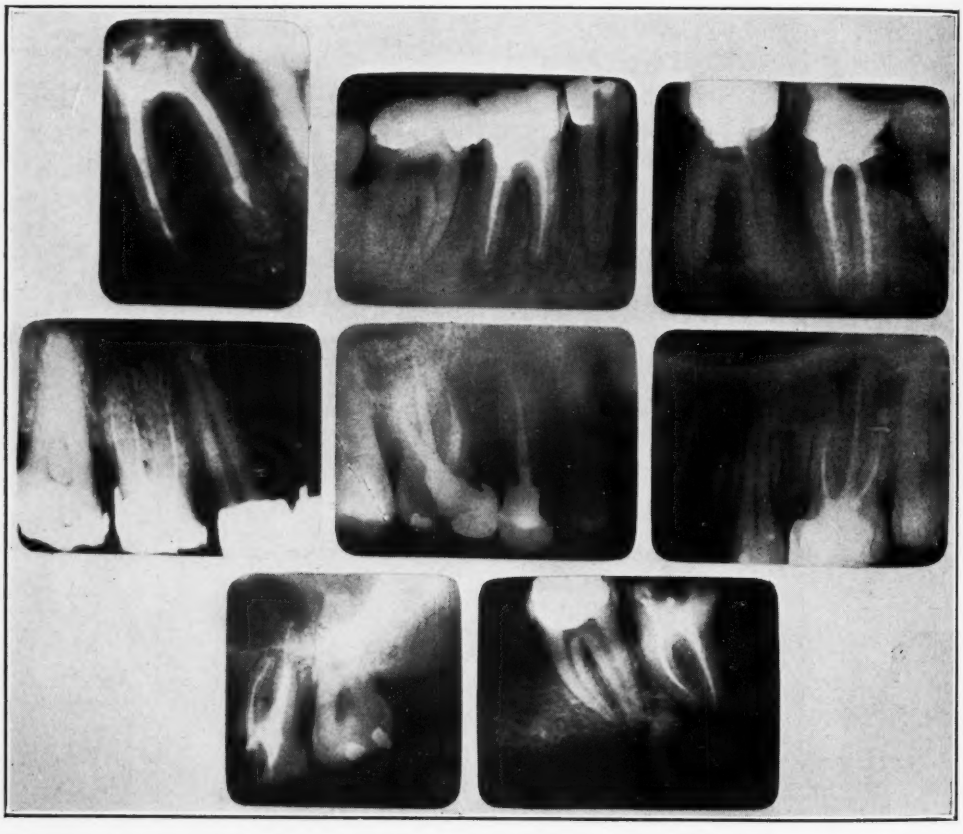


Fig. 11.—Exquisite examples of fine root fillings in multirooted teeth.

choose; dry the orifices of the canals in the cement. Remove any of the material that may have clogged this opening, and with a smooth broach proceed slowly into the canal. Dry the canal. Mix R. solution and F. powder as mentioned above (always use R. pipette for R. solution), and force it into the canal with a smooth broach, aiming to fill the canal completely to the apex, all but the center through which we will still have drainage. One application may suffice or the operator may repeat the placing of R. and F. several times during each visit. After the R. solution and F. powder have been in position for a few moments, with the C. pipette place a minim of C. solution into the mass that is already in the canal. (Never mix pipettes, as a cement will form in the

pipette. This cement can be removed with a fine broach wound with cotton then by washing through with water.) Check with the roentgenogram and dismiss the patient.

In the simple cases where there is no flow of pus when entry into the pulp chamber is made, two treatments of a few minutes duration each should suffice to disinfect thoroughly a single or a bi-rooted tooth. Teeth with three or more canals exhibiting large areas of necrosis require relatively longer and more periods of treatment.

If the apex of the canal has been sealed (as indicated by second roentgenogram) by the second treatment and there has been no discomfort between the second and third visits, the case is ready for completion. (Figs. 8 and 9.) If the root filling is short of the apex, another attempt should be made to reach the

Fig. 12. Fig. 13.

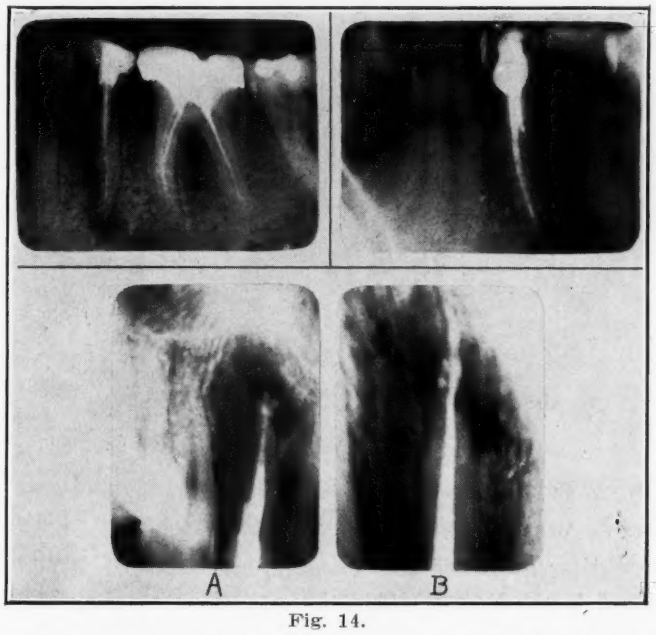


Fig. 14.

Fig. 12.—Very fine canals treated with the aid of special engine root drills.
Fig. 13.—Perforation about halfway down the root, completely filled. (Mr. L.)
Fig. 14.—*A*, Perforations at the apex and about halfway up the toot. *B*, All perforations completely filled.

root tip by passing a smooth broach through the R.C.F. already in the canal. (Fig. 10.) Mix C. solution and F. powder as in previous treatment, and carefully supplement the root filling already in place. A great advantage of this technic is that the operator may have as many trials as he desires to attain the perfect root filling without removing the material already in the canal. Several of my coworkers prefer sealing the pulp chamber half of the canal with a fine gutta-percha point. This may be left to the choice of the individual operator. Check the result with a roentgenogram. If the root filling is satisfactory, remove a small amount of the cement and prepare the tooth for any type of restoration that the case requires. Precaution should be taken to construct the restoration short of occlusion in order to permit enough time to elapse for the

repair of the periapical tissues to take place before the tooth "grows back into occlusion." Do not carve the restoration, but use the elementary rules of two-dimensional occlusion as a guide in this matter.

In the more complicated cases such as the multirooted teeth exhibiting from three to five canals, more difficulty will be encountered, and each canal should be completed as soon as the roentgenogram indicates a good canal filling. (Fig. 11.) In the finer canals where entry is not easy, the operator should use fine root drills in order to gain access to the greater part of the root. (Fig. 12.) Where it is impossible to reach the apex, do not be alarmed, for one must keep in mind that the foramen does not exist at the apex in every root. If one obtains a root filling within 2 mm. of the tip, it may be good practice to depend on chemotaxis or the permeability of the chemicals used, rather than to puncture the root in the apical quarter.

Where one encounters parts of instruments or pulp stones that are wedged in the canal, an attempt should be made to remove them. Sulphuric acid (30 per cent) will dissolve old broaches or reamers. If all attempts at dissolving or removing the root instruments should fail, an effort should be made to force some of the root filling beyond the obstructing instrument, for one must keep in

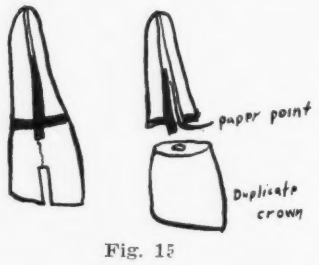


Fig. 15

mind that very few canals are round and there usually is space enough to force R. and F. paste beyond the blocking materials present in the canal.

Teeth presenting perforations can be successfully treated if the canal can be disinfected beyond the perforation. (Figs. 13 and 14.) By enlarging the gingival quarter of the canal, it is possible to pass the root instrument beyond the perforation and subsequently fill the root. The perforation should be considered another foramen. (Fig. 13.)

At times it is necessary to save an abutment for a fixed bridge or a removable denture, and upon studying the roentgenograms one may find evidence of a poor root filling with periapical necrosis or no root filling at all. The tooth in question may present a large filling, porcelain jacket, gold crown, or even a Davis crown with a large pin. These obstacles can be handled in the simple procedure of making a small opening through the filling or the crown present. Use small round burs, say No. 1 to No. 3 in amalgam and gold, and a tiny carborundum stone, which I designed especially for opening into porcelain jackets. Continue to sharpen the special stone to a pinpoint by turning it up on another larger stone. In the case of the Davis crown, one should procure a duplicate facing of the proper shade and mold and hold it in readiness before proceeding to remove the one in position. With a thin disk, cut a narrow

groove from the incisal edge of the crown in the same plane as the axis of the tooth toward the pin. (Fig. 15.) Then, with any available flat instrument, fracture the crown by applying force in the groove and at right angles to it. Make some effort to remove the pin. (See Fig. 3.) However, it is not imperative that we remove the pin, for it is wiser to make a small opening alongside the pin with a crosscut fissure bur (No. 1, 2, and 3) rather than jeopardize our chances of saving the root by splitting it in the attempt to remove the pin. As soon as the opening alongside the pin is made to communicate with the unfilled portion of the root, one should start the disinfection in the same manner as explained above in handling any septic single-rooted tooth. Where necessary for esthetic purposes, the new porcelain facing or crown may be placed on the pin between treatments, using a stiff mix of zinc-oxide and eugenol as a cementing medium. If there is a flow of pus or if there is any painful inflammation present, it is wise to leave the orifice open to permit free egress of the purulent discharge. Sometimes when the septic serum is small in quantity, I place half a paper point in the new canal with a small part projecting lingually under the crown to act as a wick in order to draw off the canal contents. In handling the above men-

Fig. 16.—Large mass of filling material forced into the necrotic zone through the maxillary second incisor.

tioned types of cases, it is necessary to keep the tooth under treatment out of occlusion at all times during the period of disinfection.

I have had an extremely high percentage of success in handling cases with a fistula present. Practically every maxillary anterior tooth with a nonvital pulp, within reason, exhibiting a fistula, should respond to this procedure. The treatment is similar to the technic used in the simpler cases, except that a greater length of time between visits is advisable to permit a maximum degree of permeability and alkalization of the structures involved.

One should take great pains when removing old gutta-percha fillings which have been sealed into position with either chloroform solutions of gutta-percha or resinous preparations. Much trouble will be stirred up if any particles of the septic gutta-percha points are forced beyond the apex of the root.

Of course the case immediately following pulp extirpation is the easiest to handle and can be completed in one visit if the time element is a factor. Otherwise, the first chemical treatment after the cement lining has been placed is to use only R. solution in the canal. This fluid should be allowed to remain unchanged until the operator is ready to dismiss the patient. Then a drop or two

of C. solution is added to the R. solution already in the canal, and the patient is dismissed for a period of twenty-four hours to a week, at the operator's discretion.

Where there is roentgenologic evidence of pathosis involving one or more teeth, only one tooth should be treated at a time, and continued drainage must be preserved in each tooth under treatment. The root fillings should not be completed until all the teeth involved in the necrotic area have been disinfected.

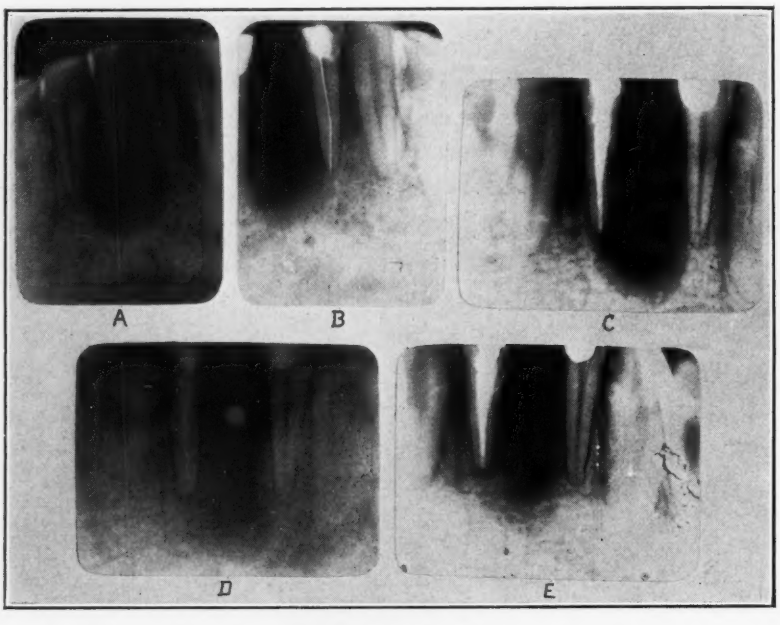


Fig. 17 *A-E.*

Fig. 17*F.*

Fig. 17.—*A*, Mandibular central incisor. Patient presented himself with chronic diffuse abscess. Tooth extracted and necrosed area curetted. Condition became acute. *B*, Diagnostic wire in place, indicating destruction of the pulp in second incisor. (Diagnostic wires are unnecessary with this technic. Why run the chance of inoculating the healthy tissue with septic material from the canal?) Two more teeth ordered extracted. Patient then came to us. *C*, First treatment with R.C.F. Note small mass of material in area where bone was removed with curettes. *D*, Second treatment. Large mass of set C. and F. paste. *E*, Four weeks later. *F*, Six weeks.

If the osteolytic process is one of long duration and the roentgenogram indicates 3 mm. or 4 mm. of demineralized bone, a small quantity of C. and F. paste should be forced through the foramen of one of the teeth into the rarified zone

at the third or fourth visit. (Figs. 16 and 17.) Choose the tooth with the straightest and largest canal leading directly to the destroyed periapical tissues. Use a smooth broach for this purpose and be gentle in the whole procedure. If a fistula is not already established, one can anticipate a slight swelling with subsequent pitting. A light yellow or whitish discharge will flow from either the old or the newly formed fistula. If examined microscopically this pus will be found to be loaded with minute spicules of declacified bone—small sequestra. This discharge will continue for days, and later the operator will note that the serum is streaked with blood. Soon the seepage will cease almost entirely, and blood can be expressed when force is applied to the area surrounding the fistula.

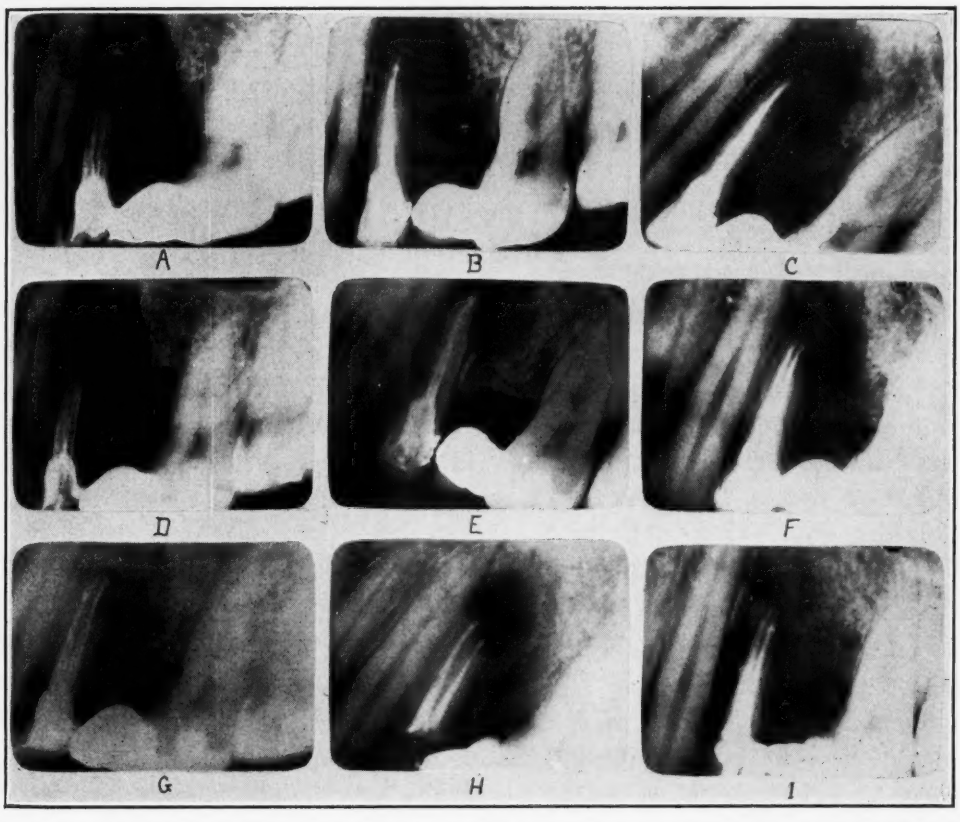


Fig. 18.—An experiment carried on in a human being, proving that it is apparently more necessary to disinfect the root structures than to fill the main canal. *A*, First treatment, canal open. *B*, Second treatment, small amount of material forced into the necrotic area. These two treatments have completely disinfected the roots of this maxillary first premolar. No further medication was used. The tooth was left open and no cognizance of the perforation was taken. At regular intervals this case was studied. *C*, *D*, *E*, *F*, and *G* indicate the bone repair that took place without any root filling or sealing of the tooth between treatments. *H*, shows a new loss of bone done surgically for study purposes, and *I*, shows the second bone repair.

Regular roentgenographic studies of this field will reward the operator with a complete graphic picture of the exquisite osteogenic process. First the dark demineralized area will show a slight cloudiness. This will be more pronounced as the C. and F. paste is absorbed or destroyed by the acidic fluids present. As the alkalization progresses, the R.C.F. immediately sets up a defense against further osteolysis by the pyogenic organisms present. This bone destruction

probably is the result, in great part, of the release of proteolytic enzymes upon disintegration of the dead bacteria. Trauma incident to chewing, as well as the presence of granulation tissue decreasing the blood supply, is another important factor augmenting the destruction of the osseous tissues.

As the pus is replaced by a new blood supply to the area, the whole process of osteogenesis can be observed. The removing of the tooth from occlusion has reduced natural trauma incident to mastication. There has been an attenuation or a destruction of the bacteria responsible for the necrosis. There is also a possibility that if any of the bacteria are still existent, the chemicals may be combining with the proteolytic enzymes released by the dead bacteria, thereby taking away the bone destructive properties of the infection. Correlated with the attenuation or the destruction of the bacteria there would naturally be an increase in the granulation tissue.

As the field is cleared of the foreign or septic material, a blood supply, as mentioned above, is reestablished. The capillary buds and the fiber cells penetrate the fibrin clot to form the basis of the new bone in the granulation tissue replacement, and the process of the mineralization of the whole involved area can be followed with the aid of the roentgenogram. (Fig. 18.) The calcium of the blood is supplemented with the calcium from the splitting of the calcium lactate present in F. powder. At first only tiny branches of osseous tissue will be observed. Next a whole series will appear, and finally trabeculation will take place, giving us a complete picture of healthy normal bone. A new lamina dura will form, starting at the lowest point along the periodontal membrane where it last existed. The histologic study will show the formation of innumerable small blood vessels, fine connective tissue fibrils, and numerous small osteogenic cells.

This ossific group begins to function as bone cells and deposits osseous matrix material among the fiber bundles. (See Fig. 3.) This original osseous trabecula marks approximately the center of the future bone. Vaguely outlining the peripheral limits of the definite bone appears a relatively thick layer of denser, more cellular matrix, the cells, in general, maintaining a fusiform shape. The bone takes shape internally by the appearance of numerous trabeculae for the formation of the initial spicules, and these then unite into sponge-like bony structures enclosing the vascular material present to form the primary bone marrow. The spicules of the cancellous bone contain many bone cells which have become enmeshed in the product of the original cells to form this osseous matrix and are in turn covered with an epithelioid membrane of a single or double layer of small bone cells, which contribute to the further growth of the bony trabeculae. We find in the marrow besides the small bone cells and the specific marrow cells, numerous giant multinuclear cells, under whose absorptive agency, assisted by a productive activity of the small bone cells and the remineralization of the osseous structures, the inner conformation of the growing bone continually alters its details.

This chemical process in normal osteogenesis invariably results in the formation of parallel laminae. These in turn make up the beautiful architecturally

designed haversian systems. A single haversian system is a small central canal occupied by connective tissue, marrow cells, nerve fibers, and perivascular lymphatics. The haversian lamellae are parallel layers of dense fibrous tissue concentrically arranged around the haversian canal. The fiber bundles of this tissue form an interlacing network with other bundles crossing at right angles and whose interstices are occupied by a solid calcarious mass, which is about 80 per cent calcium phosphate and calcium carbonate. The number of calcarious lamallae range from 4 to 20 in each haversian system. Both in and between the lamallae there are found many small spaces, which are partially filled by small flattened cells, the bone cells. These spaces are called the lacunae. From each lacuna, minute canals, the canaliculi, radiate in all directions. This permits each lacuna to communicate with its neighbor and eventually with the lymph spaces of the central haversian canal. The branching processes of the bone cells frequently project for a short distance into the canaliculi. These cytoplasmic branches are found in greater numbers in newly formed bone but later retract, and the cells become more or less shriveled in appearance. The haversian system develops around a central canal in which a blood vessel can be found and necessarily acquires a slender columnar shape. Its long axis is usually disposed in a plane nearly parallel to that plane of the bone of which it forms a part. The haversian canals frequently communicate with each other to permit a corresponding division of their blood vessels, and all the haversian canals are directly connected or indirectly connected with the periosteum, the nutrient foramina, or the marrow cavity. This forms the complete system connecting the marrow cavity and the surface—from the blood vessels of which the vascular supply is derived.

Dense interlacing bundles of calcified fibrous tissue are likewise to be found in the interstitial lamellae. Between these interlacing bundles are to be found lacunae, canaliculi, and bone cells, all disposed in a manner exactly similar to the arrangement within the concentric lamellae of the haversian systems.

The perforating fibers of Sharpey are found in the outer circumferential lamellae firmly bound together by collagenous and elastic fibers which pass from the periosteum into and through the superficial lamellae.

Bone marrow presents two types, the yellow and the red. Common to both of these is a variety of connective tissue, largely reticular, rich in fat cells and blood vessels; also osteogenic and hemogenic elements, the marrow cells or myelocytes. Yellow marrow is almost entirely fat, while red marrow contains very little fat but is so abundantly supplied with blood and marrow cells as to resemble closely a very vascular lymphoid tissue. The red marrow is to be found in the epiphyses of the long bones, cancellous bone especially in the marrow cavities of the ribs, vertebrae, base of the skull, and the sternum. It is accepted as the source of supply of blood cells in the adult. The red marrow is richly supplied with small blood vessels which infiltrate the fibrous and reticular tissues of which it consists. The small veins, having exceedingly thin walls, are so fine that they permit the blood stream to communicate directly with the pulp of the bone marrow, and it is at this point that the toxalbumins make their entry into the blood stream.

The lymphatics of bone occur as perivascular spaces in the periosteum and penetrate through to the canals of Havers thus reaching the medullary cavity. There is great doubt as to the existence of any lymphatics within the bone marrow.

The nerves enter the bone in company with the blood vessels and are to be found in all portions of the marrow. They form a rich perivascular plexus which is distributed to the walls of the vessels, occasional side fibrils being distributed to the bone marrow. There are no nerve endings in compact bone or articular cartilages. Nerve fibrils are also found as periosteum nerves of the muscles of the blood vessels and as sensory fibrils and in lamellar corpuscles.

Bone cavities of varied types and sizes (Fig. 19) have been treated and managed with R.C.F., and I believe that there remains much research work

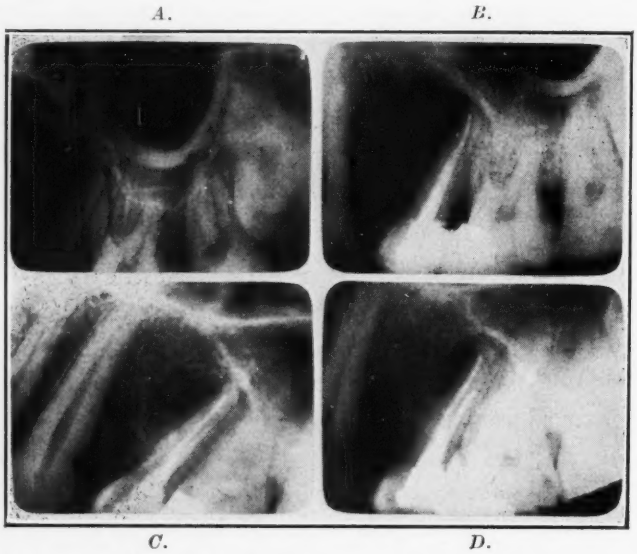


Fig. 19.—This case was treated by a senior dental student in his room. Note two canals. I have always found two canals in a maxillary second premolar or two canals that united in the apical quarter of the root. *A*, Case before treatment; *B*, first treatment; *C*, sixty days after treatment, *D*, ninety days after treatment.

to be done clinically in this field and that the solution of this problem is biochemicosurgical, rather than surgical alone.

Deciduous teeth with nonvital pulps can be treated as successfully as the permanent teeth, and it is impossible to ascertain the great benefits that humanity will derive from the general adaptation of root therapy for the deciduous teeth with nonvital pulps.*

The approach to the treatment of deciduous teeth with nonvital pulps is similar to that for the above mentioned technic, save for the following variations: no drilling or reaming in the canals because of the danger of injuring the tooth buds that are in infraclusion to the tooth under care. (Fig. 20.) Keep the patient only a few moments upon each visit to the office. (Fig. 21.)

*Those particularly interested in treating and managing deciduous teeth with nonvital pulps see: Kabnick, Stuart: Should Deciduous Teeth With Nonvital Pulps Be Treated? INTERNAT. J. ORTHO. & DENT. FOR CHILD. 19: 1043, 1933.

The objective in treating teeth with nonvital pulps is to maintain the roots of these teeth and their contiguous tissues in a clean healthy state. Where sepsis has set in, we hope to disinfect the main canal and its accessory branches and perforations, the dentinal tubuli and their branches, any openings in the cementum, and all the investing structures. If we successfully obtain this objective in treating deciduous teeth with nonvital pulps, we may utilize them as natural space retainers, a source of the necessary minerals for the formation of the lamina dura for the guidance into position of the permanent tooth, and the preservation of normal mastication during the developing stages of the child.

An ill-formed maxillary arch will involve the nasal chambers and the communicating sphenoidal, maxillary, frontal, and palatal accessory sinuses. Res-

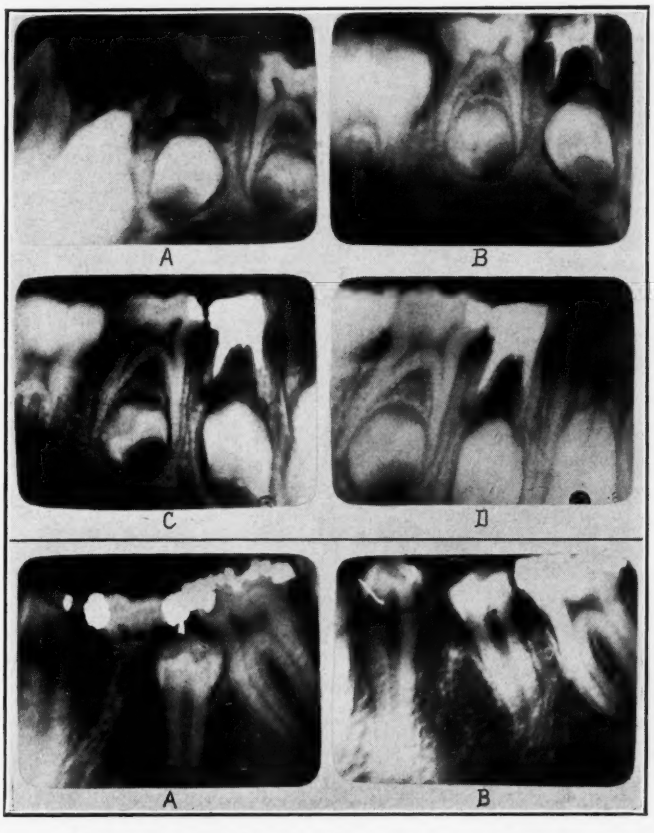


Fig. 20.

Fig. 21.

Fig. 20.—One could spend a lifetime in research on just such cases as this one. The great need for the treatment of deciduous teeth with nonvital pulps cannot be overestimated. I am of the opinion that our profession can do more for humanity through the preservation of deciduous teeth until their proper time for exfoliation than any other service that we may render. The devastating results of a septic deciduous tooth remain through the lifetime of the patient. The removal of a deciduous tooth is an insult that no mechanical space retainer can overcome, since the area involved is constantly changing its position. Another factor about which one must concern oneself is that space retainers are obtainable only by a very small percentage of children, because of the expense involved. Space retainers will not protect the tooth bud. They do not supply the necessary minerals for normal growth of the growing permanent teeth, ad infinitum!

A, B, C, and *D* show the formation of the lamina dura that will guide the first premolar into position. This is an extremely important biologic development and should be aided and not injured. *D,* Forty-five days after treatment was started, shows a new osseous protection to the tooth bud in infraclusion.

Fig. 21.—Patient eighteen years old, chronic abscess in left submaxillary region. *A* shows second deciduous molar retained by placing filling in first premolar and one in the first permanent molar distally. With the removal of the deciduous molar, the second premolar (permanent) moved into occlusion (*B*). Note that the path or journey of this tooth is between the roentgenographically evident lamina dura, existent many years after its formation.

piration is hampered! Even the olfactory bulb may become disturbed. If there is a disharmony of development of the dental arches, the deleterious effects upon the sense of hearing is manifold. The temporomandibular joint must allow for a proper-sized auditory meatus. Many apparently backward children have been found, upon testing, to show average intelligent quotients but have been prevented from advancing normally by their faulty hearing. Practically all dental facial irregularities could have been prevented, and the premature loss of deciduous teeth is one of the primary causes of such irregularities.

It is also our desire to hold permanent teeth in position for as long a time as possible in a clean state and to wipe out all metastatic infection that arises from the dental tissue. If this goal is attained, we shall have contributed our share of the work necessary to reduce the number of ulcers present all along the intestinal tract. The heart and kidneys will show less disease, as will the liver and lungs.

Fig. 22.

Specialists handling diseases that may have their origin from a chronic focal point have mentioned in the medical and dental literature that the primary lesion in many of their cases was found at the apex of one or more teeth. It is our hope to eliminate much of this pathosis. We wish to rid the body of a source of toxalbumins that have proved destructive to the urogenital tract, the circulatory system, the lungs, the nerves, and the blood, and organs where blood is produced.

THE HOLLOW DRILL METHOD FOR THE BACTERIOLOGIC STUDY OF TEETH WITH NON-VITAL PULPS, WITH SPECIAL EMPHASIS UPON THE DENTIN AND PERIAPICAL TISSUES

The drill used in this technic is an elongated hollow bur equipped with a removable spring steel shaft. It is made for both the straight handpiece and the right angle handpiece. Fig. 22 *A* shows the whole assembly, with the drill in position for culture taking of the periapical tissues. *C* shows an enlargement of the head of the drill (note opening in center occupied by spring steel shaft).

B shows the steel shaft both assembled in the hollow drill and removed. In *D* right angle handpiece with the hollow drill and shaft in position is shown.

The method suggested is as follows: When the operator wishes to study the dentin and the periapical tissues, he places the spring steel shaft 6 mm. into the pulp canal, as shown in Fig. 23 *B*. The hollow drill is then slipped over the shaft and placed either in the straight handpiece or in the right angle handpiece, as the condition requires. The drill is then placed in motion until it has cut into the tooth about 5 mm. below the floor of the pulp chamber. The handpiece is removed. Next the shaft is withdrawn, which leaves the hollow drill in a position through which a study or culture of the dentin 5 mm. below the pulp chamber can be obtained. The shaft again is placed in the drill and forced about 5 or 6 mm. farther into the canal. Repeat as described above in order to study the dentin at this point. (I have calibrated my shafts so that I can readily record the points at which the cultures are taken.) Again insert the shaft and bring it to the apex of the tooth. The drill is then driven to the root tip where a study of the periapical tissues may be obtained. It is assumed that an aseptic technic is constantly employed by the operator.

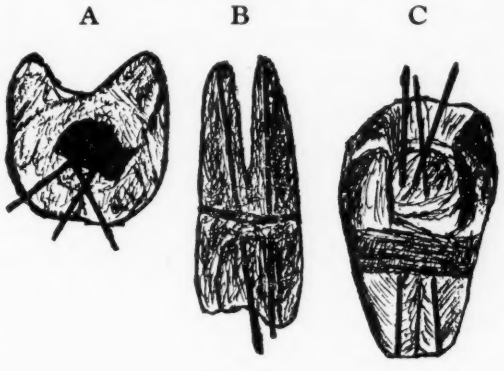


Fig. 23.

The method suggested can be used in posterior multirooted teeth as well as in anterior single-rooted teeth. The material obtained by this procedure is not contaminated, as only the tissues we wish to study are passed through and we do not depend upon the possible disinfection of tissues through which we must drill as suggested by the other technics for obtaining material for bacteriologic study of the apical tissues.

PAIN ENCOUNTERED IN ROOT THERAPY AND ITS TREATMENT

The explanation of pain attendant to root therapy lies in the irritation of the nerves in the periodontal membrane and the nerves of the soft tissues of the interproximal spaces. Where there is violent swelling involving the glands of the cheeks, the pain can be traced to the larger nerve branches as they pass through their individual foramina.

The cardinal causes of this discomfort are overambitious reaming and filling that result in forcing any débris (septic or otherwise) into the periapical tissues. Many times a chronic alveolar abscess becomes acute and violent in its

action merely by passing a diagnostic wire through the apical foramen, thereby inoculating the tissues beyond the guarded zone of the abscess, with septic or chemical canal contents. (See Fig. 17 *B*.)

Every root therapist has had the experience of cases "flaring up" the first day he opened into a tooth. I am of the opinion that the bur or drills entering the pulp chamber have acted like a piston and have disturbed the harmony of nature's defenses by forcing some of the contained gases or liquids beyond the protective walls, which are made up of fibrous tissue membranes.

The pericementum becomes inflamed, and the tooth is forced occlusally from its socket—very slightly at first, but soon the trauma caused by occluding the teeth irritates this offended member more and more. It is a vicious cycle. First the trauma caused by the force applied to the canal contents affects the periapical tissues. This results in tooth elongation and more trauma due to occlusion. This in turn further inflames the already hyperemic structure, with greater elongation resulting. Of course greater trauma will follow until this condition is relieved by grinding away the points of occlusion on the opposing tooth or teeth. The use of drugs in the tooth has no value whatsoever, and if the operator should be so injudicious as to force any of the chemicals commonly used as sedatives beyond the apex of the root into the already inflamed zone, he will probably have to resort to surgery if the ice-water spray (which I shall describe later) will not relieve the resulting swollen condition. Never force any drugs or chemicals into any tissues which exhibit an acute inflammation. After I have succeeded in removing the tooth from occlusion, I treat the pericementitis by placing any of the drugs or the essential oils commonly used for this purpose around the neck of the tooth under treatment. Immediately upon the death of the pulp, the nerve endings around the neck of the tooth, especially in the interproximal tissues, take on a new rôle, and it is here that a great deal of pain control can be obtained. Order a purge to keep the bowels free. Hypnotics or sedatives are indicated according to the degree of discomfort. A lukewarm bath will give a sense of well-being to the patient and will greatly reduce the hysteria.

Pulp stumps immediately following extirpation may cause discomfort where too great an amount of nerve tissue has remained undisturbed by the operator. Repeat the operation of the earlier attempt to remove the balance of the pulp tissue or else treat with a dressing of creosote and phenol (equal parts of each). A saturated solution of aluminum and potassium sulphate in glycerin is also used for a dressing immediately following pulp extirpation—$ALK(SO_4)_2 - 12H_2O$, large, colorless, hard, transparent crystals, crystalline fragments or white crystalline powder; astringent taste; insoluble in alcohol.

In removing inadequate root fillings great care should be taken not to force any material into the apical tissues. Remember that you do not know what chemicals were used in the former treatment of the pulp and in the disinfection of the canal or canals.

I decry the use of arsenic in root therapy because it has been my experience, years after the pulp devitalization, to observe large areas of necrosis that were caused by this violent chemical's being forced into the osseous structures.

An extremely painful inflammation (chemical) is set up, and drainage will be established through a fistula in about seventy-two hours. It is here as in all cases of chemical or bacterial inflammations that I use my ice-water spray. The regular fine spray bottles are filled with water and packed in ice. Salt sprinkled on the ice will hasten the chilling of the water. Then with the patient well draped with towels and protected with a rubber or rubberized apron, a fine cold spray is directed over the inflamed and painful zone. Use 20 pounds air pressure. Each minute sphere of cold water as it is hurled against the drawn or taut skin will stimulate the sore tissues. Just as it contacts the swollen area it takes up a definite amount of heat and rolls off into any available receptacle that has been provided for this purpose. I use a crescent-shaped pus pan held under the chin or jaw on the affected side. This bombardment of the painful lips or cheek with ice water has proved very successful in my experience and has reduced the trismus of the muscles present in most of the cases of patients who have come under my care. I have used this method freely and for periods of time up to forty minutes, breaking up the spraying time for a minute or two every five or six minutes.

Keeping the tooth open during root therapy, keeping it out of occlusion, the use of the extraoral ice-water spray, and sedatives have been invaluable in the control of pain.

TECHNIC FOR CAST INLAYS, OVERLAYS, AND SPACE MAINTAINERS*

R. E. Martin, D.D.S., and H. W. Rinesmith, D.D.S., St. Louis, Mo.

WE SHALL present the technic and procedure used in caring for children's teeth in the dental clinic at Washington University. We have decided to confine our efforts to one particular technic. Its advantages have been tested, and its value has been proved. This practical procedure is taken from the every-day practice of applying Dr. Willett's technic of cast inlays and overlays, together with the use of the space maintainers. Dr. Willett does not practice children's dentistry, but in his practice of orthodontics he has observed the need of preventive dentistry and the need of the control of the function of the deciduous teeth. He has worked out ways and means of meeting this demand.

Through observation of the clinic patients, we find that the majority of these children come from poor families, but they can be given the necessary dental care at a minimum fee. Following Dr. Willett's technic, we use a metal at a price not to exceed the price of amalgam and with the use of it still maintain normal function, with a possibility of preventing any need for orthodontic treatment later in the child's life.

As a result of this study and application, we classify the use of such technic into types of cases as follows:

1. Simple approximal cavities in deciduous molars and canines. Use cast inlay restorations.
2. Deep-seated cavities in deciduous molars and canines. Use cast overlay restorations.
3. Simple approximal cavities in central and lateral incisors. Use silver nitrate and possibly cement fillings.
4. Premature loss of deciduous teeth. Use functional space maintainers (to maintain the space and to maintain function in the process of mastication).
5. Multiple loss of deciduous teeth. Use a removable functional vulcanite space maintainer.

CONSECUTIVE STEPS IN THE INLAY TECHNIC FOR DECIDUOUS MOLARS

Make a slice groove from the central fossa of the occlusal surface from buccal to lingual, using a No. 37 or No. 38 Chayes crystolon mounted stone. With the same stones, a groove is cut from the occlusal to the proximal surface, squaring this groove with a No. 14 or No. 28 stone. Cut proximal to gingival with a tapering slice using a No. 73 wheel stone. (Fig. 1.) If caries is still present, remove with a sharp hand instrument and fill the undercuts with cement.

The preparation having been completed, a compound impression is taken in trays. We use Dr. Willett's trays, which come in three sizes, No. 12, No. 14 and No. 16 for the right and left sides. The tray is filled with S. S. W. black im-

*Read before the St. Louis Society of Dental Science, June, 1934.
(All illustrations courtesy of Dr. R. C. Willett, Peoria, Ill.)

pression compound, introduced into the mouth and forced up until the occlusal surfaces are close to the tray. As soon as this has been done and while the impression material is still soft, the tray should be moved slightly, thus making the impression a little larger. The tray and impression are now removed from the mouth and a small piece of S. S. W. exact impression (quick setting) compound is softened and placed over the black compound; put back in the mouth and forced into former position. Use considerable pressure, chill and remove from the mouth.

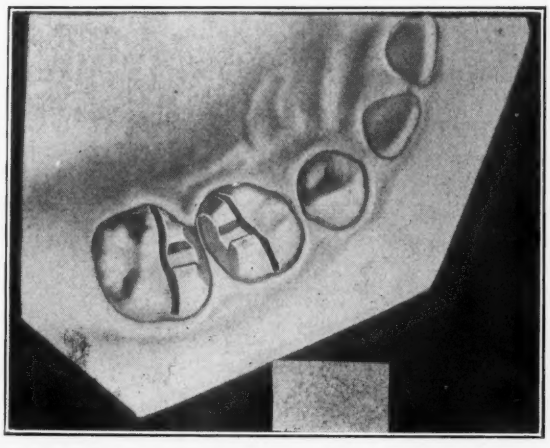


Fig. 1.—Slice cavity preparation in deciduous molars.

Fig. 2.—*A*, Position of fingers when breaking the cast; *B*, when broken apart; *C*, wax carved and completed, ready for investing and casting.

The compound impression is poured up in investment material, consisting of Loheet No. 1 and Ransom and Randolph gray investment (equal parts). Take the model and cut a groove from the base to the gingival and from the buccal to the lingual, directly beneath the contact point of the tooth selected for the inlay restoration. This allows fracturing the model at the contact point so that the inlay wax can be melted into the preparation. Place the fractured parts together in order to establish normal contact in the wax pattern (Fig. 2).

With a sharp plaster knife or plaster saw, trim the model down to within 2 mm. of the tooth covered with the wax pattern; attach a sprue, paint the wax pattern and the exposed portion of the model with Ransom and Randolph inlay paint. When the layer of paint is well set, mount the model on the sprue former and invest with Ransom and Randolph gray investment. In casting, an air pressure machine is preferred, but we have found a centrifugal machine can be used with very good results, such as the Kerr's broken arm machine. After casting, the inlay is cleaned and polished in the same manner as any other inlay, but is cemented in the tooth with Fleck's red copper cement or Ames black copper cement (Fig. 3).

THE TECHNIC FOR MAKING THE OVERLAY RESTORATIONS

Provided that there has been no exposure of the pulp, the tooth is properly isolated. The caries is removed with a sharp hand instrument, and silver nitrate

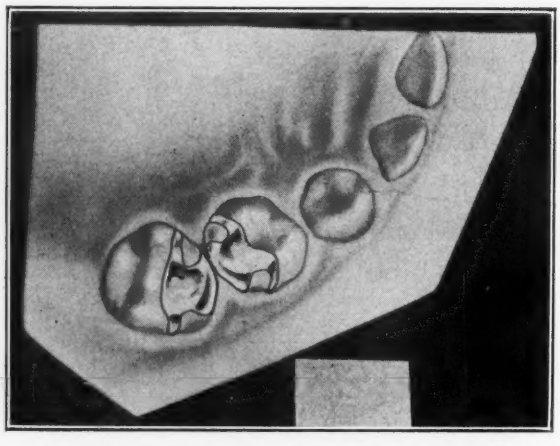


Fig. 3.—Inlays cast, polished, and in position.

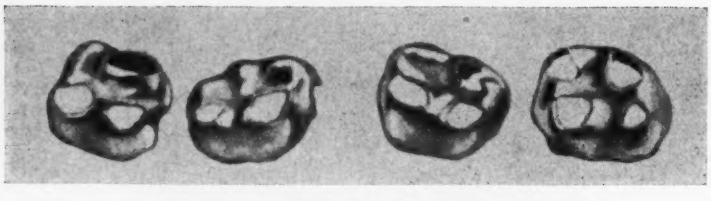


Fig. 4.—Finished cast overlays.

applied. All undercuts are filled with a nonirritating cement. The same treatment is applied if both the mesial and the distal surfaces are involved. The buccal and lingual surfaces are not touched with a stone. Under no circumstances should the operator neglect to remove all soft carious tooth structure. The tooth should be thoroughly cleaned and polished, and all foreign substances should be removed from the cervical portion of the tooth. Then a compound impression is taken, using Dr. Willett's trays with the same procedure as that used in making the inlay.

A model is made from this impression with the investment material in the same manner as that used for the inlay; that is, equal parts of Loheet No. 1 and Ransom and Randolph gray investment. While the model is still warm and

moist, following its separation from the impression compound, with the thumb and finger, lightly press to place over the tooth selected for the overlay, a piece of 28 gauge or 30 gauge sheet casting wax. Further adaptation of this wax is made with a cube of art gum, which makes the overlay of even and definite thickness when finished. The excess wax overlying the cervical margin is trimmed away with a knife blade instrument (No. 10 Bard-Parker knife), leaving about 1 mm. excess around it. We have found that a single thickness has proved to be of sufficient strength to answer all purposes. A small portion of inlay wax is melted on the point of a wax spatula and placed on the buccal or lingual wall of the wax pattern for attaching the sprue wire. We have at times

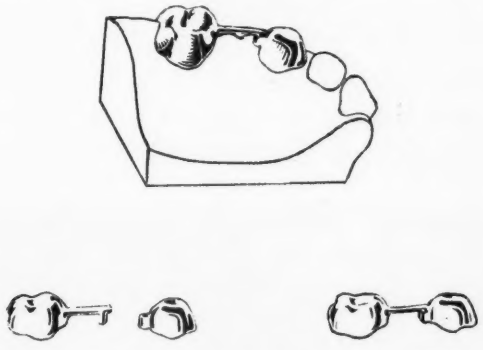


Fig. 5.—Drawing showing construction of semifixed bar functional space maintainer.

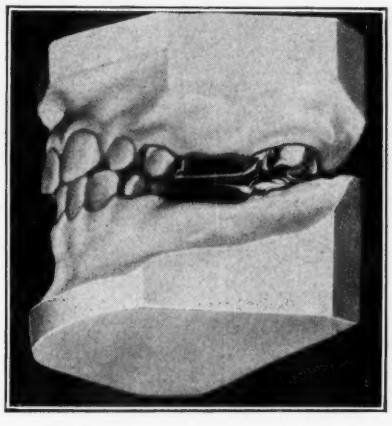


Fig. 6.—Model showing space maintainer in the maxillary arch in occlusion with space maintainer in mandibular arch.

found it necessary to flow a small portion of inlay wax around the cervical margin in order to get sufficient casting at the margin. (Fig. 4.) The method of investing and casting is the same as that for the inlay.

PROCEDURE IN MAKING THE FUNCTIONAL SPACE MAINTAINER

In the premature loss of deciduous teeth, we advocate the use of functional space maintainers. If, for instance, the first and second deciduous molars are lost before time for the premolars to erupt, then the space must be maintained. An overlay is made on the first permanent molar and another overlay is made on

the deciduous canine. We use a 14 gauge dowel wire bar across this space, the distal portion of which is soldered to the overlay on the first permanent molar, and on the mesial portion is soldered an 18 to 20 gauge wire in vertical position, to fit into a tube that has been attached to the distal surface of the overlay of the canine. The object of the pin and tube is to have the anterior end loose, in order to allow for growth and development. (Fig. 5.) If the space maintainer is to be placed in the maxillary arch, the bar should be placed slightly buccally; if in the mandibular, the bar should be placed lingually. This allows for normal function in the process of mastication, especially if two space maintainers are in occlusion with each other. (Fig. 6.)

REMOVABLE VULCANITE SPACE MAINTAINERS

In the multiple loss of deciduous teeth, we, as a rule, use removable vulcanite space maintainers. For instance, in a case of bilateral loss of the mandibular deciduous molars, the six anterior teeth remaining and the permanent molar un-

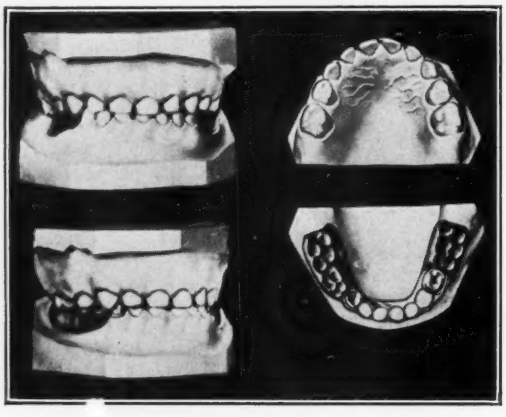


Fig. 7.—A removable vulcanite space maintainer.

erupted, take a plaster impression with an ordinary plaster tray and modeling compound impression of opposing arch.

The impression for the mandibular teeth is poured in stone and separated in the same manner as in any denture case. With any ordinary base plate material and base plate wax, make a bite rim, resting the rim on the anterior teeth above the gum line, carried posteriorly approximately to the place where the mesial surface of the first permanent molar will erupt. This bite rim is carried to the mouth, and, with the wax softened, the patient bites, leaving an imprint of the opposing teeth in the soft wax.

On the model, construct clasps around the deciduous canines the same as for any individual method of making clasps. Twenty gauge wrought or cast clasps may be used; this is flasked and vulcanized the same as any denture. (Fig. 7.)

As soon as the permanent molar erupts, make a semifixed functional space maintainer as previously described. This type prevents any depression of the erupting premolars by the pressure of the denture on the ridge.

FORMULAS

The formula for this low cost alloy, suitable for inlays and other one piece castings, is as follows:

Sterling silver	12 dwt.
One penny (U.S. coinage)	2 dwt.

Melt these two alloys together. The most satisfactory way is with oxygen gas flame.

The 12 dwt. sterling silver are first melted down on a clean charcoal block and permitted to cool to a cherry red color. The penny is then placed on top of the hot sterling silver, and the torch flame pointed directly upon it. As the penny melts down, the sterling silver melts through it. When cooled down, the mass is turned over and melted down again. This process of melting the alloy is repeated. During the process of melting and remelting, a reducing flux powder is used. Because of the low melting point of this alloy, it is not a satisfactory alloy to use in work that involves the soldering of attachments. Therefore, it is best for casting inlays or individual overlays.

The formula for the alloy suitable for casting overlays, bars and prongs for space maintainers, is as follows:

Palladium	5 grains
Pure gold	10 grains
Sterling silver	85 grains
Total	100 grains

Or if you want an ounce made up, the formula is:

Palladium	24 grains
Pure gold	48 grains
Sterling silver	408 grains

If you prefer small amounts, you can fuse these metals in your own laboratory. The five grains of palladium are first melted down on a clean charcoal block with an oxygen flame. When in a fluid state, the ten grains of pure gold are added, which forms a lower fusing alloy. The sterling silver is then melted into the mass, using the oxygen flame with caution against overheating. At no time should the molten mass of alloy become more than a boiling liquid under the flame and it should never be permitted to sputter.

In casting, this alloy appears to possess about the same physical properties as high grade gold alloys. When polished, it has a silver color which changes slightly in the mouth, but not to an objectionable degree. Eighteen carat solder can be used in soldering attachments to overlays cast in this alloy.

The time factor will be found to be an economic measure, as the operations described will take less of an operator's time in the operating room than the making and polishing of a plastic filling. The time required for setting an inlay or overlay is estimated to be from three to five minutes.

MOUTH HYGIENE FOR CHILDREN*

ANNIE TAYLOR, ATLANTA, GA.
Supervisor of Mouth Hygiene, Georgia State Board of Health

STARTING to school holds the center of interest among the people of our state. Our store windows, our newspapers, and current magazines remind us: Back to school. Are you ready for school? Get ready for school. The State Board of Health sends this message to parents: "Before you send your children to the strenuous life of the schoolroom, make sure they are not physically handicapped."

These are privileged children who are entering our schools today, privileged because they demand and receive more from our schools than any former generation. Teachers have grasped the enormous possibility of the schoolroom as a place where health habits can be inculcated as firmly as the alphabet and multiplication tables. The modern school is making every effort to keep the well child well and to bring the child physically up to standard. Thousands of grown-ups wish that the schools had had this particular enthusiasm twenty years ago. An important part of the school health program is mouth hygiene. Teeth play a most significant part in general health. The school can accomplish little without the cooperation of the home. What are you as parents doing to prepare for, encourage, and direct your child's response to mouth hygiene?

Does your child like milk, fruits, and vegetables?
Does he enjoy the feeling of a clean mouth?
Does he go to the dentist willingly twice a year?

If you can answer "yes" to these questions, then your child's response to mouth hygiene is good. If at any point you must answer "no," then your child's response to mouth hygiene is correspondingly poor.

Parents of today begin to establish proper habits of eating, sleeping, and elimination for the infant at birth. At about two years of age the habit of brushing the teeth with a small soft brush can be made most attractive because of the opportunity to play a short time in the water. At about two and a half years of age, a visit to the dentist will be another adventure. This first trip should be one in which the child investigates the office and makes the acquaintance of the dentist rather than one in which any dental work is actually accomplished.

The aim of health work today is the growth of the whole child. His physical condition is important—so are his mental reactions and his emotional responses. Therefore, great care is taken by the wise parent, dentist, and health

*A radio talk.

worker to proceed slowly and to build up confidence and happy associations with all phases of mouth hygiene—eating, brushing teeth and visiting the dentist. The healthy, unspoiled child, even before school age, makes a good dental patient.

After their confidence is won, most children are eager to follow suggestions given them about mouth hygiene. It seems too bad that their enthusiasm is dampened by indifference at home, especially when it is their little bodies which pay the toll.

Teach boys and girls that baby teeth are just as important as permanent teeth and that at about six years of age each boy and girl gets four large permanent teeth which erupt in back of the baby jaw teeth.

It is astonishing what good results small children can get with a toothbrush. They may be too little to have acquired any mastery of a proper method of brushing, and yet they will apply the brush regularly and with a will under pleasant circumstances.

The dental certificate is now used in many schools of the state as a successful means of stimulating interest in the care of the mouths of children. Dental requirements for a certificate vary, but approximately are as follows:

1. The teeth should be reasonably clean. If calculus is present, it should be removed and any gum infection cleared up.
2. All cavities in deciduous or permanent teeth should be filled, including small pits or fissures where a fine point of a dental instrument will penetrate the enamel.
3. All teeth that cannot be successfully treated or filled should be extracted, including all little pieces of deciduous roots remaining in the mouth.

We are told by physicians that decayed baby teeth often cause diseased tonsils, enlarged glands, earache, a bad heart, kidney disease, or other troubles that may last for the rest of the child's life, or they may even shorten life. Infected teeth lower the body resistance to disease and cause dull, listless children, poor school work, and sometimes failure to pass grades. If your child had abscesses on his arms, legs, or chest, would you leave them alone and make no attempt to give relief by medical care? Because a tooth is not aching is not sufficient proof that it is not causing trouble. Protect your child's health by keeping his mouth clean and free from dental infection. Teachers all agree that the well child is not only the happy child but the one who makes the best progress in school. You will find that a healthy mouth has a great deal to do with your child's health, happiness, and progress in school.

The State Board of Health wishes to impress upon every parent the importance of constant development during the foundation years. In order to achieve the highest type of mental and physical standards in adult life, every year of childhood must contribute its share. Nature never forgives the sins of omission in child care. Is your child entering school free from dental troubles?

Remember:

Healthy teeth resist decay.

Milk, fruits, vegetables, whole grains, and sunshine are good tooth builders.

There is no such thing as a cavity too small to fill.

Have the first permanent molars examined and filled if necessary as soon as they come through the gums.

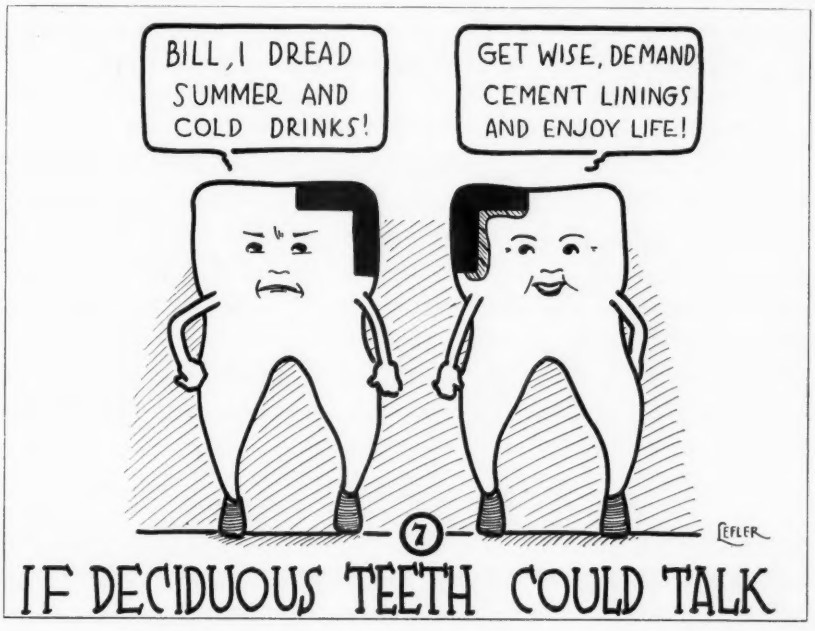
Diseased teeth and gums lower the resistance of the child or grown person.

And last, the child's response to mouth hygiene is a reflection of your own attitude; so be a good example in eating correct foods, cleaning your teeth, and visiting your dentist.

IF DECIDUOUS TEETH COULD TALK

HARRY B. SHAFER, D.D.S., ANNA, ILL.

LARGE fillings in deciduous molars irritate the pulps, which then die. The resulting abscess and swelling of the cheek speak much louder against pedodontia than the profession realizes.



This affords an excellent opportunity for those individuals not interested in children to shout in a loud voice, "I told you so." Just a little drop of cavity lining or a thin mix of copper cement will do wonders toward avoiding this, one of the greatest stumblingblocks in saving deciduous teeth.

Department of Orthodontic Abstracts and Reviews

Edited by

Dr. Egon Neustadt and Dr. Joseph D. Eby, New York City

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. Egon Neustadt, 133 East Fifty-Eighth Street, New York City.

The Migration of Tooth Germs. Abstracted from "Present Status of Knowledge Concerning Movement of the Tooth Germ Through the Jaw" by Dr. Allan G. Brodie, J. A. D. A., October, 1934.

THE FACE AT BIRTH

At birth, the face is in a very low state of development as compared with the cranium. The hard palate is at a level only slightly below the orbit. The floor of the orbit practically constitutes the base of the alveolar process.

The germs of the maxillary teeth (five deciduous and six permanent ones) are, therefore, crowded in a very small area of bone. They lie close to the floor of the orbit. The alveolar process is at this stage hardly indicated, and the maxillary sinus a narrow slit. How does this baby structure develop into the adult face? Mainly by deposition of bone on the outside of the maxilla and by absorption on its inside.

GROWTH OF THE MAXILLA

In the *downward growth* of the maxilla, new bone is laid down on the lateral surface of the alveolar process and on the under surface of the palate. The thinness of the palate is maintained by an accompanying absorption of the palatal bone on the side which forms the floor of the nose. The growth of the orbit takes place in a similar manner, but is completed at an early age.

The maxilla *increases in width* by the deposition of new bone on its outside, while simultaneously its inside is absorbed and the size of the sinus increased. The zygoma also grows by addition of bone on its outer surface and by absorption on its inner surface.

There are mainly two sources for *increase in depth* of the face: first, deposition of bone on the labial surface of the alveolar process; second, addition of bone on the site of the tuberosity in an amount equal to the combined width of three permanent molars.

GROWTH OF THE MANDIBLE

Similar changes occur in the mandible. Its height is increased by additions to the alveolar process and to the lower border. Its width is enlarged by deposition of bone on the outer (buccal) surface with a corresponding resorption on the inner (lingual) surface. Its length is increased by deposition on the posterior side of the ramus with corresponding resorptions on its anterior side.

FIRST STAGE OF ERUPTION

(Migration of the Unerupted Tooth in the Jaw)

During these growth changes, a constant transformation of the bone on the inside of the maxilla and mandible takes place. Compact bone is being changed to cancellous bone, and vice versa.

What do the tooth crypts and their germs do during this period? In the maxilla, they start from under the baby orbit, and they finally lie an inch and a half below it, to say nothing of their lateral and forward movements. Evidently their speed in movement is even greater than the growth of the bone, because they start the migration above the alveolar surface (unerupted) and later on pass it (erupted).

Furthermore, if the alveolar process moves laterally through deposition of bone on its buccal and through absorption on its lingual surface, the tooth crypt, holding the unerupted tooth, would ultimately be exposed on its lingual side. As this is not the case, it must be assumed that the unerupted tooth travels in its crypt together with the bone.

SECOND STAGE OF ERUPTION

(Emergence of the Tooth Into the Mouth)

As the tooth crypts are formed at the same early age at which the tooth crown calcifies, it becomes evident that they have to travel a considerable distance before they reach their final place where the crypt ruptures and the tooth emerges. Their movement may be due to interstitial bone changes, but in all probability it is part of that process which is called eruption.

The life cycle of a tooth may, therefore, be divided in two stages: first, its development in the crypt and its journey through the jaw to the place where the crypt ruptures; second, the emergency of the tooth from the ruptured crypt into the mouth, and its consequent further eruption.

For the eruption of the tooth into the mouth several factors have been made responsible:

(1) Elongation of the tooth root.
(2) Multiplication of the pulp cells.
(3) Deposition of new cement layers.
(4) Growth of the alveolar bone.

(Every one interested in the problem of tooth eruption will find in this article a new and instructive analysis of this complex phenomenon.)

E. N.

Changes in the Mouth Cavity During the Period of Menstruation. Abstracted from "die Veränderung der Mundhohle während der Menstruation" by Dr. Anny Klein, Zahnärztliche Rundschau, September, 1934, Berlin.

At the Women's Clinic at the University of Erlangen, eighty women were examined for the condition of their teeth during and after the period of menstruation. About one-third of them suffered from some changes that were taking place in their mouths.

One group (20) showed signs of inflammation, namely, hyperemia of the mucous membrane, reddening, swelling, pain, stomatitis, chronic aphthoides, and herpes labialis. In one case, a swelling of the salivary glands was noticed, which recurred periodically every four or eight weeks, during the time of menstruation.

Another group (12) demonstrated changes in the periodontal structures. These were evidenced by a mobility of the teeth, by menstrual periodontitis, by drawing pains in healthy teeth, or by regularly returning pains in teeth which had fillings. In 6 of these cases, the pains radiated toward the ear and cranium.

The influence of menstruation upon the occurrence of caries was studied only on those women who had not yet borne children, in order to eliminate conditions which were possibly due to their previous gravidity. Among them, there were 37 who had menses only every two, three, or four months. An examination of their mouths revealed no difference in the frequency of caries as compared to that in women who menstruated regularly every month. (This finding was contrary to the one obtained by Dr. Nessel of Vienna.)

On account of the above mentioned changes, it may sometimes be necessary that the dentist inform his patients of the influence which menstruation has upon the mouth, and that he postpone certain operations until the menses are over. In this connection it may also be mentioned that during menstruation no anesthetic should be used which contains suprarenin because the secretion of this substance is already increased during the period, and a further increase may lead to collapse, spasms, headaches, and postoperative bleeding.

E. N.

THE FORUM

Articles for this department should be sent to Dr. Albert H. Ketcham and Dr. William R. Humphrey, 1232 Republic Bldg., Denver, Colo.

Mottled Enamel and Fluorine

Mottled enamel is definitely associated with the ingestion of fluorides. Children who drink water which contains 1 p.p.m. (parts per million) or more of fluorine while the enamel of their teeth is being formed will almost certainly develop this lesion. The defect is proportionate to the amount of fluorine. Water containing 1 p.p.m. of fluorine will almost certainly produce relatively mild defects, and that containing 4 or 5 p.p.m. will produce very severe defects. Some children are more susceptible than others to the toxic influence of the same fluoride water.

Mottled enamel is grayish white and nontranslucent in appearance. It may or may not be associated with brown stain, and the latter may be scarcely noticeable or may be very disfiguring. Mottling is the primary defect, and the brown stain occurs only after the mottling has been produced.

The various kinds of food contain too little fluorine, if any, to have any effect on this condition. Milk from cows that drink water with 2 p.p.m. fluorine does not contain sufficient fluorine to be demonstrated by either colorimetric or spectrographic methods. The drinking water is the harmful vehicle, and for this reason the defect is endemic.

Since the enamel defects are permanent, it is necessary that the drinking water of children from their first few months of life contain less than 0.5 p.p.m. fluorine if the defects are to be avoided. It is not now practicable to eliminate fluorine from a water system which contains it. Unless a new source of water with less than the toxic amount of fluorine can be provided, it is necessary that either distilled water or imported fluorine-free drinking waters be given children while their teeth are developing. Only in this way is it possible for children in endemic regions to escape enamel defects that may be very disfiguring.

W. F. Drea.

Should the Undergraduate Dental Student Treat Orthodontic Cases?

This is a problem with which the faculties of every dental school have had to struggle continually during the last twenty-five or thirty years. The evolution of orthodontia during this period has been rapid, and the changing conditions have had their influence on the plans of teaching in the dental schools.

The schools do not, at the present time, have a uniform policy concerning orthodontic instruction. In some schools an effort is made to educate the dental

student so that he will be capable of including orthodontia in his practice. Other schools stress the importance of the dentist's recognizing abnormal developments of the dental apparatus and of preventing and intercepting malocclusion, but they do not expect their graduates to participate in the practice of orthodontia.

According to the recently published report of the Committee on Orthodontic Education of the American Society of Orthodontists,* covering a survey of forty-three dental schools in the United States and Canada, twenty-five schools require clinical practice of orthodontia; in seventeen schools clinical practice is optional, and one school gives no clinical instruction. In several schools the clinical instruction consists of observation by the students of patients treated by instructors. In seventeen schools all adjustments of appliances are made by instructors. In twenty-one schools the students adjust the appliances, assisted by instructors in six of these schools. In twenty-three schools the students make the appliances used. In eighteen schools the appliances are made by instructors or technicians. Four schools use ready-made appliances. The time devoted to clinical practice and observation in thirty-six schools averages eighty-three hours.

The report also states that data resulting from a nation-wide survey made within recent years indicate that about 50 per cent of the dentists in the United States practice some orthodontia. Owing to the fact that a large proportion of the population of this country is not located convenient to cities of sufficient size to support a specialist in orthodontia, it seems logical that the teachings in orthodontics in the dental school curriculum should be sufficiently comprehensive in character to prepare the dentist not only to recognize abnormal developments and to be able to prevent and intercept malocclusion, but also to treat the simpler phases of malocclusion.

For this reason I believe that the dental student should have clinical experience in orthodontia. However, a dental student must have sufficient preparation, consisting of an increased amount of time devoted to study, technic, and observation, before he actually engages in the treatment of malocclusion. It would seem logical that didactic and technic work should be carried on during the first two years of the dental course. During the third year he might observe cases being treated by an instructor, and during the final year he could personally undertake the clinical practice of orthodontia. This practice should be done with the advice and constant supervision of a capable instructor.

I do not want to leave the impression that a dental graduate, having fulfilled the requirements of study and clinical practice outlined, would in my opinion be qualified to practice orthodontia as a specialty, but he would at least be much better equipped to deal with matters of prevention and treatment of malocclusion than is the average dentist at this time.

Charles R. Baker.

Problem of the First Deciduous Molar

The operative management of a Class II cavity in the first deciduous molar is one of the most important and difficult problems faced by the dentist, and one

*International Journal of Orthodontia and Dentistry for Children, August, 1934.

which probably requires the exercise of more care and skill in the cavity preparation than any other class of filling. The operator doing children's work should familiarize himself with the external anatomy of these deciduous molars and have in mind at all times a clear picture of the shape of these teeth, with their extreme bell contours constricting sharply inward immediately below the gingival margin in the interproximal space. He must also visualize the internal anatomy of this tooth with its pulp cavity almost twice as large, in relation to the size of the tooth, as that of the permanent molar. A failure to consider these things during cavity preparation will cause disaster in one of two ways: either a continual breaking out of the fillings from lack of proper retention or the more serious condition of the death of a large number of pulps resulting from exposure.

Statistics have shown that the distoclusal cavity in a mandibular first deciduous molar apparently is the cause of more trouble to the dentist than any other cavity in the child's mouth, and the placing of a satisfactory restoration in this location, in the mouth of a two- to five-year-old child, is a challenge to the patient, knowledge, and ability of any operator. It is indeed pitiful to observe in the mouth of a three-year-old child a large gob of silver amalgam packed into the interproximal space between the first and second deciduous molars, with no attempt at cavity preparation, a very superficial removal of caries, and no restoration of contour or contact point. Such plugs (they cannot be called fillings or restorations) invariably become loosened in a short time under the stress of mastication, and then act as a very efficient plunger at every meal, forcing saliva, food débris, and bacteria directly into the cavity and causing pulp death in a very short time. Fortunately such dental tragedies are not observed so frequently today as they were a few years ago before children's dentistry assumed its present important place in dental work. But they are still seen far too often, and the man who will impose upon an innocent child and a trusting parent with this class of work is guilty of abusing the confidence of his patients and obtaining money under false pretenses.

A few simple rules regarding cavity preparation in these teeth will bear repetition and may assist the operator in filling this type of cavity.

1. Gingival seat and dovetail retention are absolutely necessary.

2. Dovetail should be cut wide at the neck but not deep, giving greater body of metal to prevent fracture without endangering the pulp.

3. Buccal and lingual extension of cavity margins to prevent the recurrence of caries is not necessary unless the enamel walls are undermined, because the use of copper amalgam prevents the recurrence of caries.

4. Copper amalgam is the filling material of choice; it provides protection from recurrence of caries, ease of manipulation, and (with the addition of a small amount of silver) immediate setting to reduce the possibility of fracture.

5. A matrix should always be used.

6. Restorations should be contoured to the original shape of the tooth, and if arch expansion has taken place, providing natural spaces between the other molars, such a space should be left between the restoration and the approximating tooth. This is important.

7. Pulp capping is seldom successful, and if exposure is made it is generally advisable to devitalize and remove the pulp, thus reducing the possibility of an abscess.

8. Two approximating cavities should never be filled at the same sitting. Let one filling set, and at the next appointment build your contact to it.

Paul A. Barker.

Fee or Service?

Dr. Frank H. Harrison's article in the November Forum, entitled "Naming the Fee," is most timely, for during this period of financial stress a great number of people feel that above all else they must count the cost; therefore, one of the first questions asked by these people is, "What will treatment cost, and how long will it take?"

As Dr. Harrison has pointed out, it must be admitted, to the shame of our specialty, that some orthodontists name a fee at once without explaining the necessity of first making a thorough diagnosis. Such a procedure is unfair to the parent and to the orthodontist, and in the best interest of both the answer to this question should be withheld until the case has been thoroughly studied.

Often the situation may be explained to the parent by means of a simple comparison such as the following: "If you should ask a builder how much he would charge to build you a home and how long it would take him, you would scarcely expect him to answer until he had seen the plans and specifications. It would be even more difficult for me to give you an answer now. The orthodontist's problems are much more complicated than the builder's, for he is dealing with problems of nutrition, growth, and other life processes. His problem is made more difficult by factors, such as habits, which may be of importance in causing the condition from which your child is suffering and which, if not corrected, may prolong treatment. Treatment may also be prolonged by a lack of cooperation on the part of the child or parents. Therefore, it is necessary to have models and x-ray pictures of your child's teeth and jaws so that these may be studied before your next visit and at that time be compared with the child's face and jaws. Your child's case appears to be of this type." (Here select models and photographs of treated cases, and point out deviations from normal, also show models or skull having normal occlusion of teeth.)

Usually at this stage the parents have become interested, and photographs of cases showing pernicious habits, faulty breathing, and consequent facial deformity may be shown to advantage. Often parents are interested in the development of the nasal cavity and sinuses, or in a proper diet.

If the orthodontist will take time to enlighten the parents in regard to the true meaning of orthodontic service, he can often make a desirable patient out of an indifferent prospect.

After all this may come the question, "But, Doctor, I know that this is expensive work and, I fear, beyond my means. Can you give me some idea of how much it might cost so that I may decide whether it is practicable to make this diagnosis?"

One answer is, "I can tell you our fee for treating the average case which runs about ------ for the first year's treatment, ------ for the second, ------ for the third, and ------ for the fourth. The period of active treatment may consume one year's time or longer, then, after a period of rest, there may be a second period of active treatment at a time when teeth now unerupted may need guiding into correct positions.

"Many factors may be of importance in determining the course of treatment. There may be impaction or absence of some of the permanent teeth which should succeed the deciduous teeth now present. There may be supernumerary teeth. The roots of the permanent teeth may be abnormally formed or the calcification of the jaw bones may be deficient. Often the wisdom teeth are in unfavorable positions. Therefore, we must secure a complete set of x-ray pictures and models to determine deviations from normal. These help to give us a fair idea of the difficulties which will be encountered in the treatment of your child's deformity. If, after we have made a careful diagnosis, you feel that you cannot afford treatment, then you can pay us for diagnosis and consultation."

The orthodontist will be able to secure information in regard to financial responsibility of the parents before they return with the child to have the diagnosis completed and learn the amount of the fee.

Wealthy people should pay a fee which fully reimburses the operator for his services. When the financial report shows that people are in moderate circumstances, the orthodontist may tell the parents, "As members of the healing art we realize that we must make it possible, if our time and finances permit, for you to have your crippled child treated; therefore, if you will tell us your circumstances we shall do everything within our power to make this correction possible."

Usually at this point the parents will give a frank statement of income and disbursements. Then the orthodontist may remark, "While we charge well-to-do people a fair fee for our services which, in a case presenting difficulties similar to that of your child's, in your case we should charge only -------." If the parents find this amount to be outside their budget, ofttimes arrangements can be made which are mutually satisfactory and for which the parents will express their deep appreciation.

Arrangements to start treatment having been made, including the method of making payments; a financial form letter is shown the parents with the information, "Our secretary will give you a letter which is a memorandum of your financial arrangement with us. There will be enclosed a copy which you are to sign and return to us."

Following is a typewritten letter which several orthodontists have found useful:

Date_____

Mr. and Mrs. _____,

_____.

Dear Mr. and Mrs. _____:

As is our custom, we are sending you this memorandum of the financial agreement for treatment of the malocclusion of your (son or daughter) _____'s teeth, by our organization, that you may have it for future reference:

For the first year's treatment $_____ (from —/—/— to —/—/—) to be paid _____. For the second year's treatment $_____. For the third year's treatment $_____. For the fourth year's treatment $_____. If further treatment is necessary thereafter, the fee will be $_____ per year.

It is understood that treatment may be discontinued at any time if work performed up to that date is paid for in full. The most difficult part of treatment and the greatest expense to us are in diagnosis, constructing appliances, and starting the treatment of a case; therefore, should treatment be discontinued during the first year, the first year's fee will be due.

A charge will be made to cover cost of replacing lost or broken appliances when, in the opinion of the operator, the accident is due to carelessness or neglect on the part of the patient. Read carefully the notice on the back of the appointment slips. Appointments broken without twenty-four hours' notice will be charged for depending upon the length of time assigned to the patient.

Sincerely yours,

_____.

We accept the terms of
the above agreement:

_____

_____

_____

The secretary encloses a letter which she signs:

Date_____

Mr. and Mrs. _____,

_____,

_____.

Dear Mr. and Mrs. _____:

We are enclosing our regular letter containing the financial arrangement for the treatment of the malocclusion of your (son or daughter) _____'s teeth.

Kindly acknowledge duplicate copy and return to our offices, retaining the original letter for your future reference.

Thanking you, we are
Sincerely,

_____.

(If previous arrangements for payment have not been made, the following may be added:)

P.S.: It is our custom to render a statement for the first half of the first year's fee at the beginning of treatment; for one-half of the balance at the end of six months; and for the remainder at the end of the first year's treatment; thereafter statements are sent at the end of each six months' period. If you wish us to render statements on some other basis, please indicate your wishes when you return copy of the enclosed agreement.

An appointment slip is also enclosed, on the back of which is printed the following:

YOUR APPLIANCES

Your appliances are made from a composition of pure gold, platinum and iridium, more costly than your best jewelry. Hard or sticky candy or a blow in the mouth often loosens or breaks the appliances.

AVOID: Hard or sticky candy; scuffling where you are liable to receive a blow in the face or to catch the appliances upon the clothing.

A charge will be made to cover cost of replacing lost or broken appliances, so BE CAREFUL.

Brush your teeth after each meal. Our nurses will show you how.

Only today, on his second visit, a small scamp of a boy who was referred from a distant city said, "I would have pulled off my bands, but I read on your appointment slip that I would have to pay if I did. The other orthodontist did not charge when I broke my appliances." The orthodontist who referred the case wrote that he was about to discontinue treatment because of continual breakage of appliances.

A. H. K. and *W. R. H.*

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EDITORIALS

Extraction of Teeth in Treatment

THE leading article in the October issue of *Dental Digest* is entitled "Judicious Extraction in the Treatment of Malocclusion," by Samuel Fine, D.M.D. There is an editorial note by the editor, preceding the article, in which he says: "It is widely known that thousands of cases of malocclusion go untreated because of economic reasons. It is also generally accepted that in the treatment of malocclusions by regulating appliances it is seldom necessary to extract teeth. There are, however, thousands of children, some indigent, and others inaccessible to orthodontists, who cannot be given the advantage of orthodontic care. Dr. Fine, therefore, describes a technic which is *not* a substitute for orthodontic treatment but a stop-gap of necessity. The ideal condition is for every child suffering from malocclusion to receive skillful orthodontic attention, and

every dentist should so inform parents of such children. To do less is a serious professional dereliction. We present this article by Dr. Fine, expecting that some orthodontists may criticize us severely. If, however, one single child should be benefited by this type of treatment, and none injured, we will feel justified in presenting this technic to the profession. *We wish to warn readers again that this treatment even in properly chosen cases is intended only in those cases in which orthodontic treatment is not possible to obtain."*

The principal interest to orthodontists in this article will be the last paragraph in the editorial note quoted above in which the editor of *Dental Digest* more or less raises the protecting shield of alibi and figuratively, at least, ducks in anticipation of brickbats which may follow as a result of the author's recommendation of the extraction of sound teeth to expedite the treatment of malocclusion for children. The same cautious vein is obvious in the orthodontic theme of the author throughout the article, wherein an effort is apparently made to back up and support each contention for the extraction of teeth by citation of various and random quotations from orthodontic authors, some dating into the past as remote as 1888.

The editor in the introductory note says: "If, however, one single child should be benefited by this type of treatment, and none injured, we will feel justified in presenting this technic to the profession." There does Dr. Ryan spark again the time-honored extraction controversy which it has been thought was buried long ago when he says if there were "none injured." The contention has been made that when the dental profession collectively starts to extract teeth in children's mouths for the correction of malocclusion, it is more often the case that the injury worked thereby far offsets any improvement which is made because many times little thought is given to the problem of which tooth should be extracted, and in many instances exactly the wrong one is removed, which may cause inharmonious development of the entire dental arch by the time the individual becomes an adult and the arch has fully formed.

Many members of the dental profession will remember the controversy of Case-Angle-Dewey-Ketcham and others many years ago in regard to the extraction of teeth for the correction of malocclusion, which is now orthodontic history. That battle was one of the most important and tenaciously argued controversies which has been staged on the floor of formal meetings in American dentistry. The clash of the controversy is now forgotten; however, memories remain, and this latter fact, no doubt, accounts for the extreme caution and cat's-paw-like stealth with which authors approach the obviously sacred subject of the extraction of teeth in order to correct malocclusion. The careful approach exhibited in the *Digest* article, however, is rather superfluous because the majority of the cases reported in which this author extracted teeth are mutilated and somewhat matured cases, and there never has been any particular controversy over the feasibility and practicability of the extraction of teeth in mutilated cases in adult life. In these cases compromise treatment is oftentimes the only way for improvement; there may be no other choice.

Orthodontists of full experience know it is a hazardous procedure to advocate the extraction of teeth for the correction of malocclusion because the results of the extraction of teeth in children many times are not obvious until after

from three to ten years of growing adolescence. It requires the elapse of much time to manifest the facial disproportion which may result from the extraction of, for instance, a first premolar on one side. It requires time for the median line of the mouth to become distorted, with its subsequent shifting of the entire occlusion of the mouth to one side. Accordingly, it is difficult to be impressed favorably in regard to the efficacy of the extraction of teeth in the treatment of certain cases of malocclusion by submitting only the evidence of the photographs of plaster casts and of the teeth. When extraction technic has been resorted to and several years have been allowed to elapse, often the esthetic appearance of the teeth in the anterior part of the mouth has been improved; however, the facial appearance may be plainly distorted. Orthodontists do not usually attempt to prove the merits of a treatment which involves the extraction of sound teeth without at the same time offering in evidence both profile and full front photographs of the patient before and after treatment. The extraction of the first premolar in younger children usually allows the area about the nasal sulcus to be underdeveloped in growth and leaves lines on this area of the face. If maxillary teeth are extracted on one side only, after a few years elapse definite disproportion may occur in the osseous structure supporting the teeth, which manifests itself in facial disproportion. In other words, to offer as an exhibit in evidence of the merits of the extraction treatment only photographs of the teeth and of plaster casts, means that the evidence for it begins only with the teeth and ends there, and the results of the extraction of teeth in growing children do not discontinue there—occlusion and facial disproportion are both highly important and must be carefully considered and discounted in advocating treatment.

Advising the extraction of teeth for the correction of malocclusion is not new to orthodontists; however, it is realized, as pointed out in the editor's note, that it is a dangerous subject, and while possibly indicated in some cases, it should not be done without full appreciation of the importance of a full complement of teeth in the balance and harmony of facial expression and without a careful diagnosis and survey. Some of the author's statements directed to the dental profession at large are an injustice to the specialty; for instance, he states, "I have read that if an orthodontist obtains from 30 to 40 per cent successful results, it is considered a good average." This statement plainly has no more authority behind it than "I have read" and should not be broadcast indiscriminately to the dental profession. Any average person knows that no specialty in medicine or dentistry could grow to the proportions that orthodontia has grown if it had 60 to 70 per cent of failures. This statement can be discounted as careless, speculative opinion.

Ever so often some one writes an article after having ostensibly discovered that the extraction of a tooth or teeth will cause anterior teeth ultimately to assume a better esthetic appearance; then follows the usual avalanche of the extraction of canines, lateral incisors, and first premolars in children's mouths, and the resultant sequel of irreparable damage which is familiar to every orthodontist and to every exodontist.

To observe the facial imbalance of the patient forty years old whose maxillary canine has been extracted on one side or both sides at the age of fifteen

years, is to know why orthodontists view the extraction of children's teeth for the correction of malocclusion with extreme alarm and why extraction is utilized only as a last resort by men of very wide experience.

Extraction is like many oil stocks: it is more appetizing and makes a better showing in the short pull than it does in the long, and it appears to better advantage when evidence is shown of the teeth alone than it does when the whole lower third of the face is checked as to results in growing children. The author of the article and the editor of the *Digest* are very careful to point out that this type of treatment is advocated only as a "stop-gap"—a compromise to be used only in extraordinary situations in order to bring about some improvement for the child and that it is a treatment fraught with hazard and danger and is even now being overindulged in by those who are inclined to discount the importance of a full complement of teeth as related to the growth of the face and jaws. Orthodontists have made and will make no mistake in urging the dental profession to retain all the teeth in the mouth of growing children as long as possible before resorting to extraction, and then to use extraction only as a last resort. This treatment makes a spectacular photographic showing but as a general rule carries a backwash of an unsatisfactory ultimate finish that makes orthodontists extremely shy of it.

H. C. P.

Recent Action on Socialized Dentistry

Of interest to the readers of this Journal and to all American dentists is the fact that on November 20 the Ad Interim Committee and the Economics Committee of the American Dental Association met with a special committee recently appointed by the Board of Trustees of the American Medical Association to formulate plans for future activity leading to closer cooperation in all questions of mutual interest.

The exhaustive studies that have been made of health insurance laws and plans in the thirty-seven countries in which they are in use have demonstrated that these plans for providing medical and dental care are not applicable to meet the needs of our country.

As a result of those studies and conferences the Economics Committee prepared the following resolution which was adopted by the Ad Interim Committee of the Board of Trustees of the American Dental Association: "The American Dental Association is opposed to the enactment of legislation along the lines of so-called compulsory health insurance until the health professions are fully satisfied that the interests of the public and the professions are properly safeguarded."

BOOK REVIEW

Exhibit for Dentistry at a Century of Progress, International Exposition, Chicago, 1933-1934

This booklet is a portrayal of problems of dental health and the prevention of dental disease, with which are interwoven the development of the profession and the history of dental practice. The booklet has been prepared by Arthur D. Black and was published to supply material for public lectures on dental health. A limited number of copies are available. Lantern slides and other illustrations in this booklet can be obtained: The Talking Tooth (12 slides in colors), Pyorrhea (12 slides in colors), and the moving picture film (28 slides). Address Bureau of Public Relations, American Dental Association, 212 East Superior Street, Chicago, Ill.

The exhibit was prepared to acquaint the public with the evolution, which has taken place during the past century, of dentistry from a mechanical art to a highly efficient profession. It portrayed the rôle of the mouth and the teeth in the development of facial symmetry, the accuracy of speech, and the beauty of appearance and expression; it also stressed the importance of conserving the teeth as a means of maintaining good health. From the Talking Tooth to the moving picture, the exhibit emphasized the need for better care of the teeth of young children as a logical beginning in the prevention of those infections which are a menace to health later in life. The exhibit was sponsored by the Chicago Centennial Dental Congress under the auspices of the American Dental Association and the Chicago Dental Society.

NEWS AND NOTES

Rocky Mountain Midwinter Clinic

The Midwinter Clinic of the Denver Dental Association will be held January 9-12, 1935, at the Cosmopolitan Hotel, Denver.

ALBERT P. HORTON, *Secretary*
1550 Lincoln Street
Denver, Colo.

Great Lakes Association of Orthodontists

The annual meeting of the Great Lakes Association of Orthodontists will be held January 28 and 29, 1935, at the Hotel Statler, Detroit, Mich.

RALPH P. HOWARTH, *Secretary*
1140 Hanna Building
Cleveland, Ohio.

Chicago Midwinter Meeting Plans Progress

Looking forward to the largest and most successful Midwinter Meeting in four years, officials of the Chicago Dental Society, under the Presidency of Dr. Stanley D. Tylman, are busy with their committees arranging the details of this annual meeting which is to be held at the Stevens Hotel, Chicago, February 18, 19, 20, and 21, 1935.

The unique position occupied by the traditionally successful Chicago meeting is due to a combination of factors, principal among them being the diversification and excellence of the program; the painstaking efforts of a large number of experienced, enthusiastic committeemen; the geographical location of Chicago coupled with the city's reputation as a winter resort; and last, but by no means least, the unequalled facilities in which to stage the meeting. Located in Chicago's "front yard" on Michigan Boulevard, the Stevens Hotel with its 3,000 rooms with bath, large number of well-appointed meeting rooms, and commercial exhibition hall occupying 32,000 square feet of space, provides ideal quarters to house this important event.

Already the Program Committee has practically completed its gigantic task, and the roster of essayists reads as though it might well be a "Who's Who" of American dentistry. General practitioners and specialists from all parts of the United States will be on hand to present the fruits of their experience and research in dental problems. The clinics, too, will be numerous, and will enable the visitor to acquire, in an intensely practical manner, information concerning processes and technics that make the practice of dentistry more efficient and, consequently, more satisfactory.

The commercial exhibits are always a major attraction at the Chicago meeting, and preliminary reports from the Exhibit Committee point conclusively to a display of supplies and equipment that will command the interest and study of every dentist who prides himself on being modern and progressive. The manufacturers have played no small part in the

onward march of dentistry, and their representatives will be on hand to explain the latest and best technical aids designed to facilitate dental practice.

The social aspect of the meeting will not be overlooked. Headlining the social functions will be the dinner dance and entertainment in the spacious and magnificent Grand Ballroom of the Stevens; the Annual Frolic, also in the Grand Ballroom; and the ladies' luncheon and entertainment. Special groups, fraternities, and college alumni associations will also hold affairs for their members.

In short, the full four days have been planned in the light of many years of experience to provide education, entertainment, and good fellowship for all. Every member of the American Dental Association is invited to attend and enjoy the benefits of a practical mid-winter holiday.

Dental Society of the State of New York

The Society will hold its Sixty-Seventh Annual Meeting June 12-15, 1935, at Saranac Inn, Upper Saranac, N. Y.

A cordial invitation is extended to all ethical dentists to attend the sessions.

The following preliminary information is presented:

Dr. H. J. Burkhart, Chairman of Program Committee
Box 879,
Rochester, N. Y.

Dr. L. L. Abbey, Chairman Clinics Committee
619 Union Street,
Schenectady, N. Y.

Dr. H. R. Mead, Chairman Exhibits Committee
619 Union Street,
Schenectady, N. Y.

Further information may be obtained by writing to:

Dr. Augustave Neuber, President
619 Union Street,
Schenectady, N. Y.

Dr. A. P. Burkhart, Secretary
57 E. Genesee Street,
Auburn, N. Y.

European Orthodontic Society

The European Orthodontic Society will hold its meeting at the Langham Hotel, London, W. 1, on July 29 and 30, 1935, with Dr. Sheldon Friel as its President. Many eminent European orthodontists have signified their intention of being present and reading papers or giving clinics and demonstrations. They look forward to a very interesting meeting, as there is a marked and growing desire to acquire knowledge of this fascinating subject.

The meeting will be immediately followed by the annual meeting of the American Dental Society of Europe, and it is expected the attendance will be a large one. Doubtless, when the final arrangements are made, there will be an exchange of hospitalities between the two societies, which was the arrangement of the last meeting at Scheveningen, The Hague, in May, 1934.

The European Orthodontic Society, by invitation from the Secretary, Mr. G. F. Cale-Matthews, is very eager that co-patriots of America attend this meeting and contribute to the program.

The officers of the European Orthodontic Society at the present time are as follows: President, C. F. L. Nord, The Hague; Vice President, E. J. Van Den Berg, Amsterdam; Secretary, G. F. Cale-Matthews, London; Editor and Treasurer, O. Henry, London. Board of Censors: J. T. Quintero, Lyon; F. Stuhl, Paris; E. D. Barrows, London.

Report of the Fourteenth Annual Meeting of the Southwestern Society of Orthodontists

The Fourteenth Annual Meeting of the Southwestern Society of Orthodontists was held at Abilene, Texas, on October 15, 16, and 17, inclusive. The meeting was of great value to all who were interested in orthodontia.

Some idea of the mental stimulus that was gained from this meeting may be had by giving a brief outline of the program.

With only a few changes the regular prepared program was presented.

The guest speakers were Dr. Clinton C. Howard of Atlanta, Ga.; Dr. Walter Leabo of Shreveport, La.; and Miss Nena Kate Ramsey, Abilene. Dr. Clinton C. Howard presented an excellent paper, "The Correlation of Jaw Growth With Skeletal Growth." (Synopsis: Growth as a life process, though little understood, constitutes the most important study in orthodontic education. An attempt will be made to amplify the problem of determining the most advantageous time for assisting nature in overcoming the malgrowth of the arches and jaws. The question of multilation can be scientifically determined.) This paper was enthusiastically received and aroused much interest and discussion.

Dr. Walter Leabo presented a very interesting paper on the "Aspects of Periodontia," of fundamental importance in every phase of dentistry.

Miss Ramsey gave an exceptional paper, a subject about which most of those present at the meeting had never heard and which was closely related to orthodontic study. The title of her paper was: "Some Recent Studies in Palotography."

We hope that it will be possible for Miss Ramsey to present this paper at the next meeting of the American Society of Orthodontists in New York.

Dr. Homer B. Robison, Dr. T. Wallace Sorrels, Dr. Paul Guy Spencer, and Dr. G. C. Turner gave greatly appreciated papers. There were twenty-one interesting clinics, and they were well prepared.

At a banquet held at the Hilton Hotel on Tuesday evening, October 16, the Southwestern Society presented a bronze tablet in honor of the late Dr. Martin Dewey. Dr. P. G. Spencer delivered a very appropriate address of presentation.

At a business session of the Society resolutions on mail-order orthodontia laboratories resolutions regarding orthodontic education were passed. [Similar resolutions have been passed by various other orthodontic groups at their recent meetings.]

Officers elected for the ensuing year are: Dr. Louis Winston, Houston, Texas, President; Dr. Curtis Williams, Shreveport, La., President-elect; Dr. Harry Sorrels, Oklahoma City, Secretary-Treasurer. Dr. A. B. Conley, Dr. Frank Harrison and Dr. J. H. Weaver were re-elected to the Board of Censors, Dr. T. W. Sorrels, chairman. Dr. Homer B. Robison and Dr. T. G. Duckworth were re-elected on the Educational Committee.

Houston, Texas, was unanimously selected as the next meeting place of the Society.

CURTIS WILLIAMS, *Secretary.*

Report of the Fall Meeting of the New York Society of Orthodontists

The fall meeting of the New York Society of Orthodontists was held November 12 and 13, at the Waldorf Astoria Hotel, New York, N. Y. The program consisted of the following presentations:

"The Temporomandibular Joint; Its Consideration in Orthodontic Diagnosis," by Sidney E. Riesner, New York. "The Behavior of the Temporomandibular Joint in Response to the Myofunctional Treatment of Distoclusion," by Alfred P. Rogers, Boston. Dr. Leuman M. Waugh of New York reported on plans for the Thirty-Third Annual Meeting of the American Society of Orthodontists. "Observations on a Few Problems in Orthodontia," by Frederick C. Kemple, New York. Discussion was opened by John V. Mershon, Philadelphia, and Milo Hellman, New York. Case reports were presented by the Orthodontic Department of Columbia University. "Straightening Teeth," by Bernard W. Weinberger, New York. "Gnathostatics," by Allen H. Suggett, San Francisco. "Orthodontic Education," by B. E. Lischer, St. Louis.

The following clinics were given: "Short Cuts in Remodeling Lingual Arches," by Alfred M. Desnoes. "Parallel Soldering of Attachments to Bands," by Mabel Thomas. "Waxable Vulcanite in Construction of Hawley Retainers," by Paul Hoffman. Demonstration of Surgimold was given by a representative of Surgident Company, Ltd., East Hollywood, Calif.

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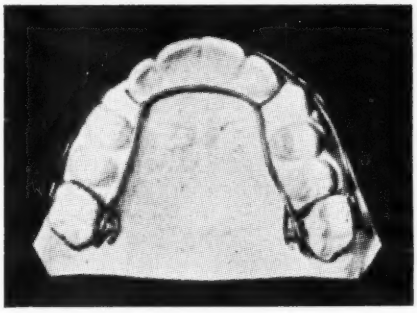

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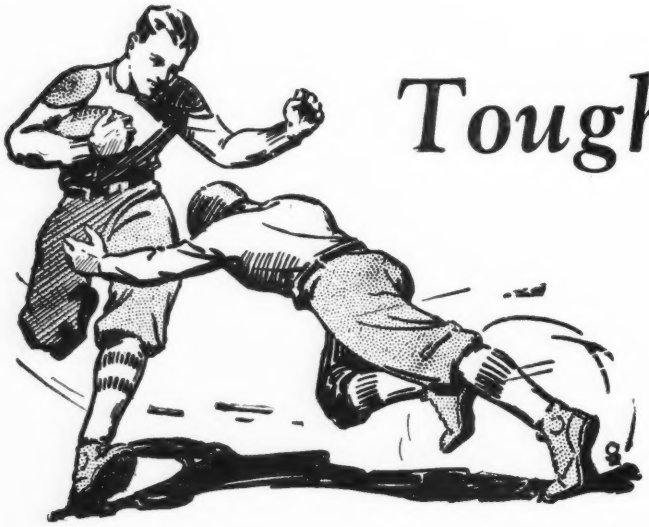

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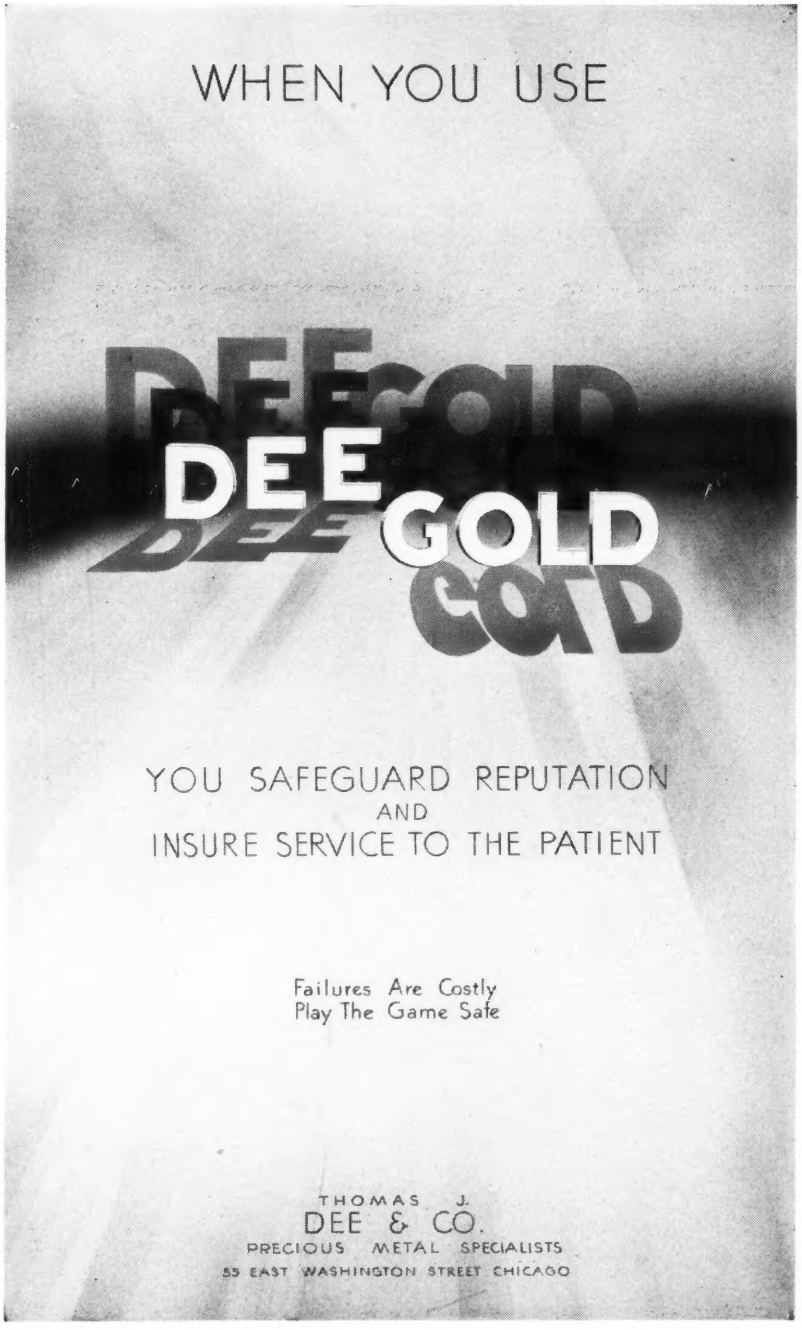
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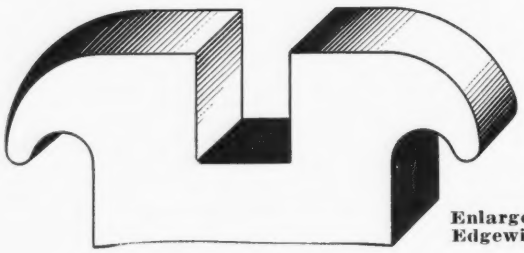

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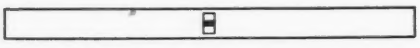

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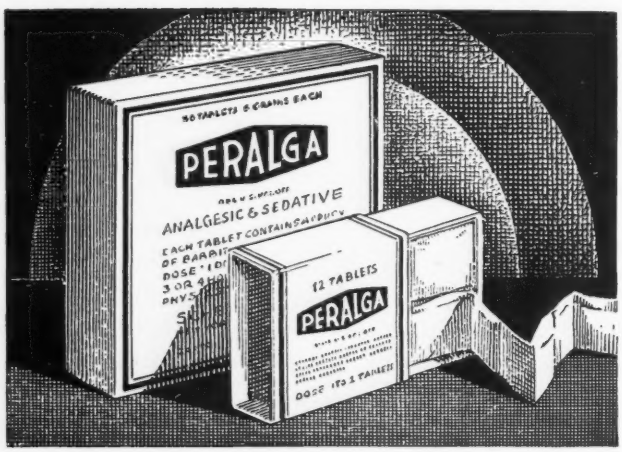

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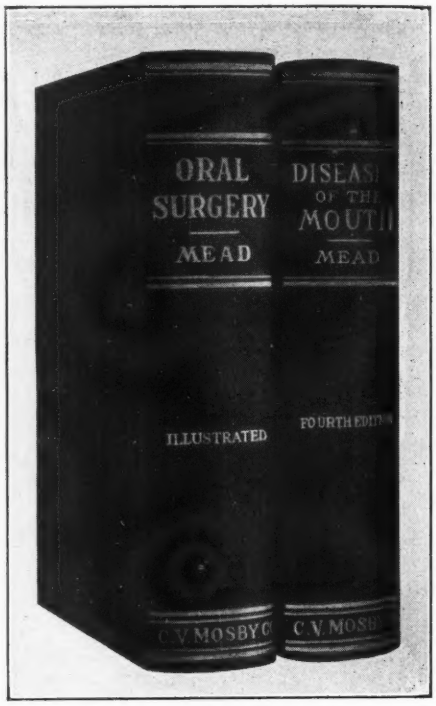

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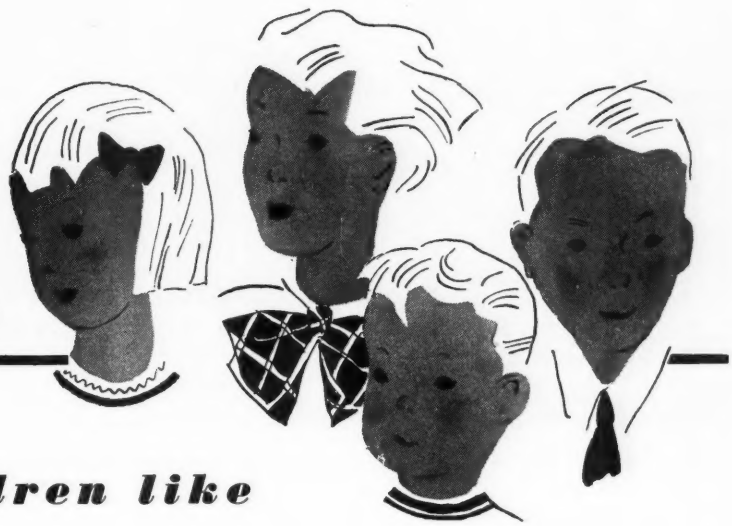

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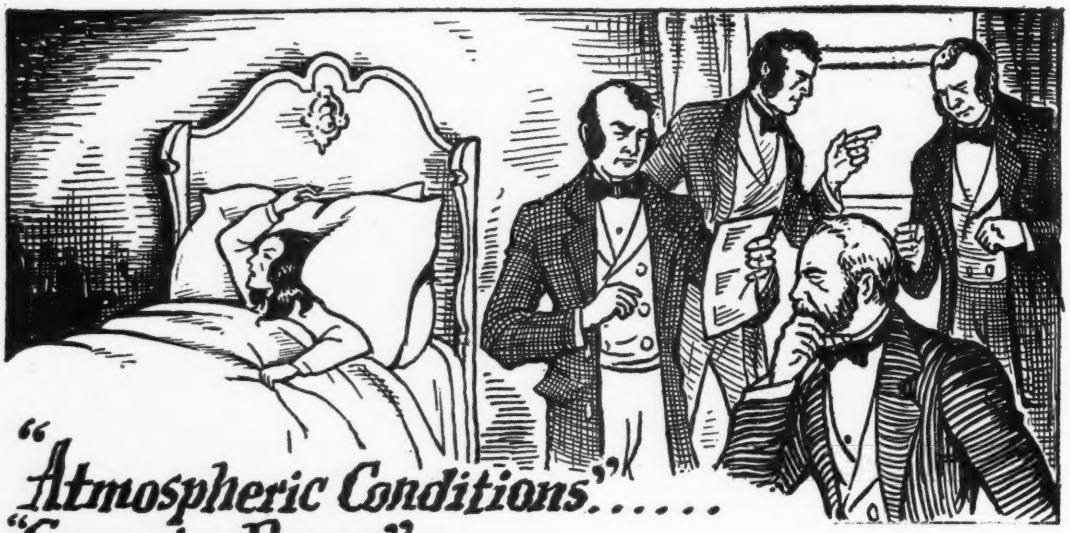

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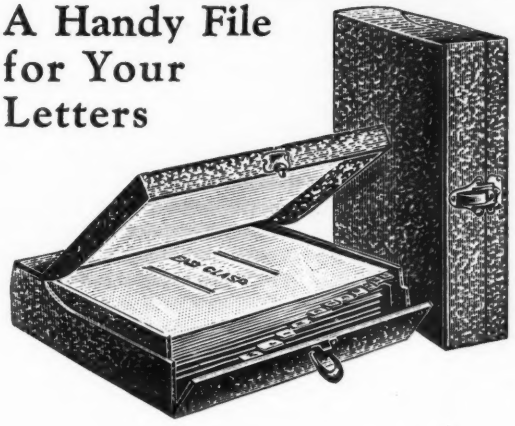

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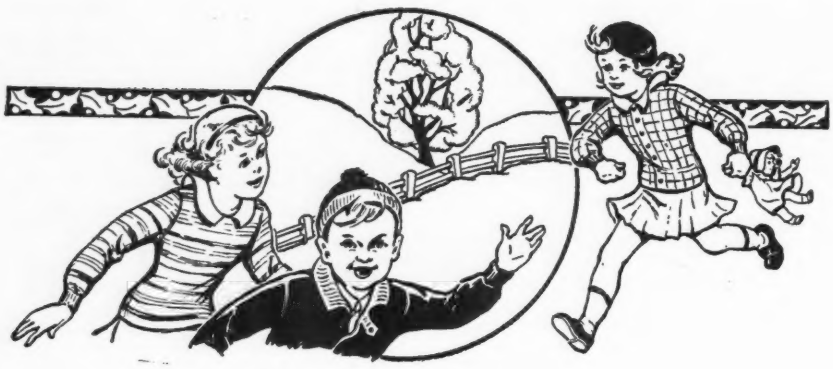

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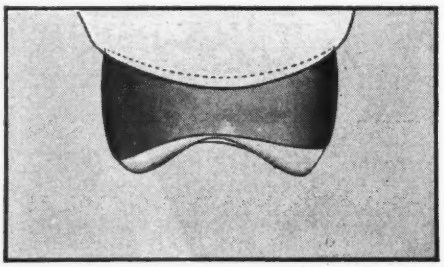

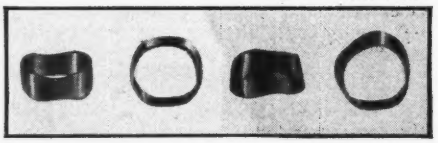

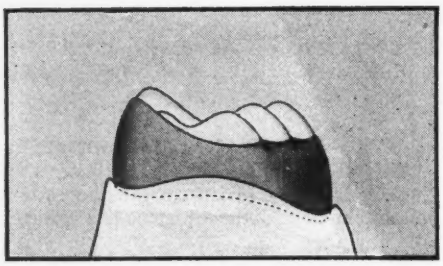

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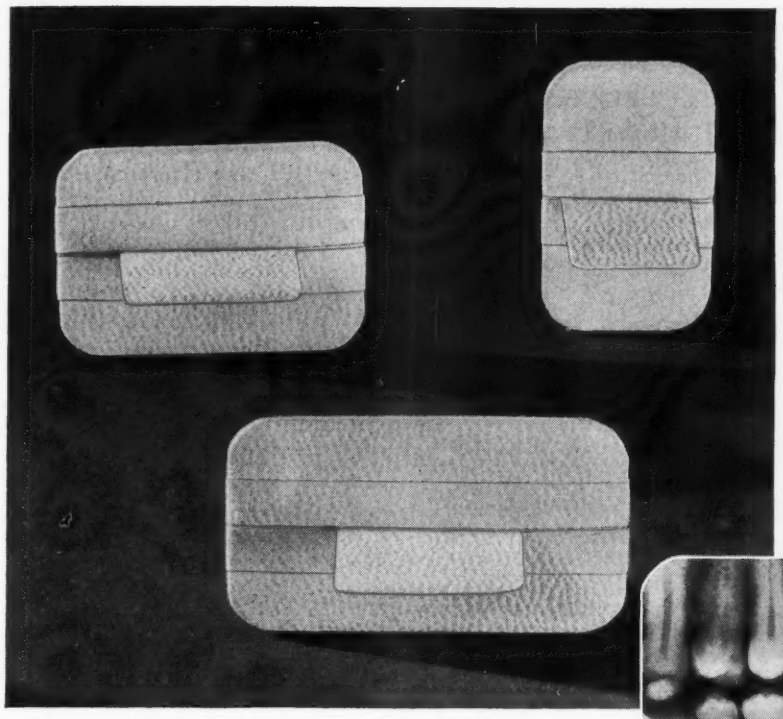

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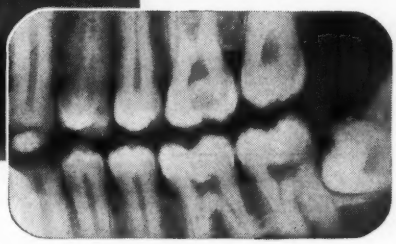

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